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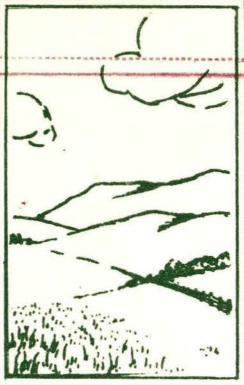

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THE GENUS CHRYSOTHAMNUS IN CALIFORNIA AND WESTERN NEVADA

By

Beryl Schreiber Jespersen

Agricultural Aide

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By

Beryl Schreiber Jespersen

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The current interest in rubber-producing plants that may be used to relieve the present rubber shortage has stimulated this study of the genus Chrysothamnus. Since certain species of Chrysothamnus have been found to contain rubber (3), interest in this genus has become widespread. The species and varieties of the Chrysothamnus complex, however, present a difficult problem in identification. Most previous treatments of the genus have proved too technical for the layman; hence it seemed desirable to compile usable keys and less technical descriptions to aid him in distinguishing the various species and varieties.

The Chrysothamnus complex has been discussed exhaustively by Hall and Clements (2). However, their extensive monograph is not easily used in the field, although their work has formed the basis of the present study. This has been supplemented by a critical study of specimens in the University of California herbarium that were annotated by Hall and of specimens collected by the vegetation type survey (6) crews.

Only forms that grow in California and western Nevada are discussed here, since this area is the geographic unit with which the vegetation type survey is concerned. The area designated as western Nevada includes Washoe, Storey, Ormsby, Douglas, Lyon, Mineral, and Esmeralda Counties.

In the following discussion the descriptions of the species and varieties are presented in charts with illustrations[1/] to facilitate comparison of characters. The keys which precede the charts should enable the field man to identify the plant, first to species and, in subsequent keys, to variety. Certain species cannot be further segregated to variety and hence appear only in the key for species identification. After the keys, charts, and discussion, the important synonymy is given for plants growing within the area concerned. The specimens listed verify range and supply the basis for the localities given on the distribution maps. Discussion of the species and varieties is confined chiefly to the Chrysothamnus nauseosus complex since, of the Chrysothamnus species, this group is the most difficult to identify. Inasmuch as C. nauseosus is a possible source of rubber, it is especially important to be able to distinguish it from other species of the genus. The varieties of C. nauseosus vary in rubber content, some having more rubber than others. The percentage of rubber in the shrubs of other members of the genus is negligible, according to Hall (3). It is also necessary to discuss the C. viscidiflorus complex, because of its abundance and the nomenclatural problems involved.

1/ The author is indebted to Mrs. Patricia R. Haskey of the California Forest and Range Experiment Station for the illustrations on the charts.

The genus Chrysothamnus belongs to the Compositae or sunflower family and is a member of the Aster tribe. The generic name, which is derived from the Greek words meaning gold (chrysos) and shrub (thamnos), refers to the numerous bright yellow flowers. The genus comprises about 12 species with many subspecies or varieties native to the arid regions of western North America. Chrysothamnus is commonly called rabbitbrush because rabbits shelter in the dense thickets formed by the shrub (3).

The nearest relative of Chrysothamnus is the genus Aplopappus, a large group of shrubs and herbs. Jepson (4) regards certain members of the genus Aplopappus as distinct and hence places them in separate genera. These genera include Stenotopsis, Ericameria, Aplopappus (perennial herbs), Stenotus, Isocoma, Hazardia, and Macronema. Hall, however, in his monograph of the genus Aplopappus (1) includes these above-mentioned genera under the several sections of Aplopappus. Whether or not one considers them to be distinct, Chrysothamnus may be differentiated from Aplopappus by its very narrow involucres and the tendency of the involucral bracts to form vertical or nearly vertical rows. Hall believes this latter character comparable to that of alternate and opposite leaves and therefore equally important in distinguishing genera (2).

The genus Chrysothamnus Nuttall (5) may be described as follows:2/ Shrubs or subshrubs with erect or ascending stems. Herbage with or without hairs, often resinous and aromatic. Leaves simple, alternate, entire. Flower heads in flattened or rounded, dense or loose pyramidal clusters, spikes, panicles, or racemes, rarely solitary. Involucres cylindrical, bracts mostly keeled, overlapping and in more or less vertical rows, papery or leathery with tips sometimes greenish. Ray flowers none. Disk flowers 4-20 in a head. Flowers tubular-funnelform, 5-toothed. Achenes slender, rounded or slightly angled, with or without hairs. Pappus of copious soft, dull white to reddish bristles.

2/ For illustrations of scientific terms used in this paper, see Illustrated Glossary, p. 36. A millimeter rule is given on p. 36 for use in the field.

KEYS, CHARTS, AND DISCUSSION

The seven species of Chrysothamnus that occur in California and western Nevada may be separated by the following key:

Key to the Species of Chrysothamnus

Chart 1, pp. 4-5

Leaves dotted with impressed resin glands or densely resinous viscid.

Leaves rounded, not flat or drying threadlike; heads in broad panicles or short dense spikes; flowers deep yellow, 6-6.5 mm. long; corolla lobes 1 mm. long.

Heads in broad branched terminal panicles, rarely subracemose; involucral bracts without thickened spot or gland at the tip.
1. C. paniculatus

Heads usually in short dense spikes; involucral bracts with thickened brown or green spot at the tip and often a thick resin gland.
2. C. teretifolius

Leaves flat, drying threadlike; heads in small congested corymbose clusters; flowers white or very pale yellow, 7-8 mm. long; corolla lobes 2-2.5 mm. long. 3. C. albidus

Leaves not dotted with impressed resin glands; variously hairy, glandular-hairy or without hairs, viscidulous but not densely so.

Branches covered with compact feltlike hairs.

Heads in leafy terminal racemes; involucral bracts 10-20.
4. C. Parryi

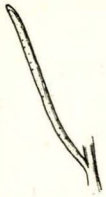
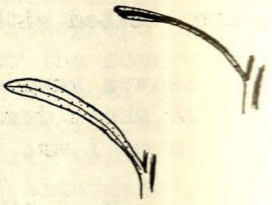
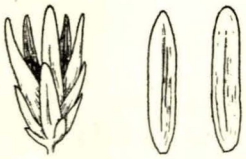
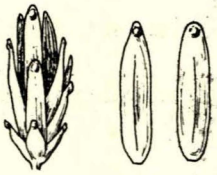
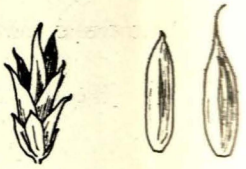
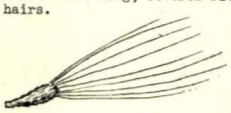
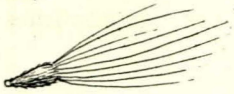
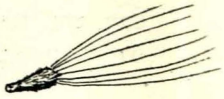
Heads in compact or loose, rounded or flat-topped cymes or elongated pyramidal thyrses; involucral bracts 20-25.
5. C. nauseosus

Branches without hairs, hairy or glandular-hairy but hairs not compact and feltlike.

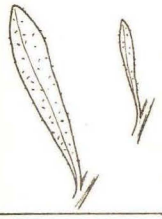
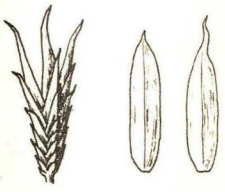
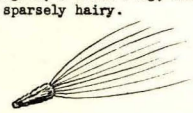
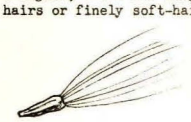
Leaves usually lax, often much twisted, finely soft-hairy or without hairs, only the margins occasionally rough-hairy; involucral bracts about 15, not in obvious vertical rows, not keeled, blunt or taperpointed. 6. C. viscidiflorus

Leaves rigid, rarely slightly twisted, the surfaces rough-hairy; involucral bracts 20-25 in 5 sharply defined vertical rows, keeled, abruptly short-pointed or often ending in a soft awn.
7. C. depressus

1. CHART DESCRIPTIONS OF THE CHRYSOTHAMNUS SPECIES

SPECIES	1. paniculatus (Gray)Hall	2. teretifolius (D. & H.)Hall	3. albidus (Jones)Greene
HABIT	Broad, rounded shrub 2-6 feet high, with several or many main stems from the base; twigs brittle, spreading, leafy, without hairs but resinous and viscid, at first green and dotted with impressed resin glands, later turning brown.	An irregularly branched, rounded shrub 1-3 feet high; twigs erect, brittle, leafy, without hairs but dotted with impressed resin glands, green later becoming reddish-brown.	Fastigately branched shrub 1-3 feet high; twigs brittle, erect, very leafy, without hairs but very resinous, at first green, becoming whitish.
LEAVES	Linear, rounded, 1-3 cm. long, shorter in the inflorescence, rigid, without hairs, but very resinous and dotted with impressed resin glands, green or sometimes grayish with a waxy bloom. 	Linear, rounded, 1-2 cm. long, only moderately shorter in the inflorescence, rigid, without hairs but dotted with impressed resin glands.	Flat and 1-2 mm. wide, drying threadlike through inrolling of the margins, 2-4 cm. long, lax, without hairs, copiously resinous and resin-pitted. 
INFLORESCENCE	Heads in broad branched terminal panicles, rarely subracemose.	Heads usually in short, dense spikes at the ends of the branches.	Heads in small congested corymbose clusters at the ends of the branches.
INVOLUCRE	5-6 mm. high; bracts 13-17, in 5 obvious but not sharply defined vertical rows, blunt, without hairs and without spot or gland at the tip. 	6-8 mm. high; bracts 16-20, in 5 sharply defined vertical rows, blunt or occasionally pointed, without hairs but with a conspicuous green or brownish thickened spot at the tip, often with a thick resin gland. 	7-9 mm. high; bracts about 15, in obscure vertical rows, all but the inner abruptly narrowed to a long bristlelike usually curved tip, without hairs, glutinous, the margins somewhat ragged, the tip sometimes green. 
FLOWERS	5-8; about 6 mm. long; lobes lance-ovate, about 1 mm. long, nearly erect.	5-6; 6-6.5 mm. long; lobes lanceolate, about 1 mm. long, erect or slightly recurved.	5-6; 7-8 mm. long; whitish or pale yellow; lobes linear, 2-2.5 mm. long, erect.
ACHENES	5-angled, about 4 mm. long, covered with appressed hairs. 	5-angled, about 5 mm. long, densely appressed-hairy. 	About 4 mm. long, densely hairy. 
DISTRIBUTION General	Southwestern Utah across northern Arizona to the Colorado and Mohave deserts in California as far west as Tehachapi Pass.		Great Basin area: common only along the westerly side of the Salt Lake Desert; Utah; Nevada and eastern middle California.
California & western Nevada	Arid sandy, stony slopes and gravelly washes; California: Colorado and Mohave deserts from Riverside County northward to the eastern slope of the Tehachapi Mountains, Kern County north to Inyo County; western Nevada.	Gravelly hillsides and rocky canyons; California: mountains of Inyo County and along the eastern borders of the southern Sierra Nevada Mountains, southward and westward in the Tehachapi Mountains, San Gorgonio Pass and the Santa Rosa Mountains; western Nevada.	California: Owen's Valley, Inyo County; western Nevada.

1. CHART DESCRIPTIONS OF THE CHRYSOTHAMNUS SPECIES (Cont'd.)

SPECIES	4. Parryi (Gray)Greene	5. nauseosus (Pall.)Britt.	6. viscidiflorus (Hook.)Nutt.	7. depressus Nutt.
HABIT	Shrubs 2 feet or less high, with numerous erect or ascending branches; twigs flexible, ascending, moderately leafy, covered with white or grayish-green, compact, feltlike hairs.	Shrubs varying from 1-8 feet high, forming rounded bushes; twigs flexible, erect, moderately leafy, covered with white or gray-green, compact, feltlike hairs or with copious, loose, woolly hairs.	Variable shrubs 4 inches to 8 feet high; twigs brittle, erect, leafy, without hairs or finely hairy, pale green or white.	Low shrub or subshrub 4-18 inches high forming irregularly branched, dense clumps; twigs brittle, minutely rough-hairy.
LEAVES	Narrowly to broadly linear, 1-8 cm. long, 0.5-8 mm. wide, green and viscid-glandular, or gray and hairy. (For illustrations see chart 2)	Threadlike to broadly linear, not twisted, 2-7 cm. long, 0.5-5 mm. wide, hairy or sometimes without hairs. (For illustrations see chart 3)	Narrowly linear to oblong or lanceolate, often much twisted, 1-6 cm. long, 1-12 mm. wide, 1-5-nerved, finely soft-hairy or without hairs, viscidulous, the margins commonly rough. (For illustrations see chart 4)	Oblanceolate to spatulate, occasionally lanceolate, erect, 0.8-2.5 cm. long, 2-5 mm. wide, 1-nerved, rarely 3-nerved, rigid, finely hairy. 
INFLORESCENCE	Heads in leafy terminal racemes, these sometimes branching. (For illustrations see chart 2)	Heads in terminal rounded or flat-topped cymes or elongated thyrses. (For illustrations see chart 3)	Heads in rounded or flat-topped cymes at the ends of the branches. (For illustrations see chart 4)	Heads in small, compact, rounded clusters at the ends of the branches.
INVOLUCRE	10-14 mm. high; bracts 10-20 in more or less obvious vertical rows, lanceolate, the outer ones often with a slender greenish tip, loosely hairy at least on the margins. (For illustrations see chart 2)	6-13 mm. high; bracts usually 20-25, in obvious vertical rows, lanceolate, pointed or blunt, with or without hairs, often glandular or glutinous. (For illustrations see chart 3)	5-8 mm. high; bracts about 15 in poorly defined vertical rows, not keeled, broadly- to linear-oblong or lanceolate, pointed or blunt, without hairs or minutely hairy. (For illustrations see chart 4)	8-12 mm. high; bracts 20 or 25 in 5 sharply defined vertical rows, boat-shaped, keeled, usually with an abrupt, short point or soft awn. 
FLOWERS	4-20; 8-11 mm. long; lobes 0.5-2.5 mm. long. 	Usually 5, rarely 6; 7-10 or rarely 12 mm. long; lobes 0.4-2.5 mm. long, erect or spreading. (For illustrations see chart 3)	About 5, 4.5-7 mm. long; lobes 1-2 mm. long, erect to recurved-spreading. 	5, 5-9 mm. long; corolla lobes lanceolate, 1-2.3 mm. long, nearly erect.
ACHENES	4-angled, 5-6 mm. long, densely hairy. 	5-angled, 5-5.5 mm. long, densely hairy to without hairs, or hairy only on the prominent ribs. (For illustrations see chart 3)	5-angled, 3-4 mm. long, densely to sparsely hairy. 	4-angled, 3-5.5 mm. long, without hairs or finely soft-hairy. 
DISTRIBUTION General	Mountains and foothills of western North America; Wyoming to western Nebraska, New Mexico, California, Nevada and Utah.	Plains and mountains, chiefly of the Great Basin area, but extending from Saskatchewan and the Dakotas to Colorado, western Texas, northern Sonora, Lower California, the inner coast ranges of Upper California, eastern Washington, eastern British Columbia and Alberta.	Plains and mountains of western North America; North Dakota to New Mexico, eastern California, British Columbia and Montana.	Plains and lower mountains of the southwest; southern Colorado and New Mexico to northern Arizona, Utah, Nevada and eastern California.
California & western Nevada	(See under varieties, chart 2)	(See under varieties, chart 3)	(See under varieties, chart 4)	California: New York and Clark Mountains, San Bernardino County.

Key to the Varieties of *Chrysothamnus Parryi*

Chart 2, pp. 8-9

Leaves broad, elliptic, oblanceolate, or narrowly oblanceolate, 4-13 mm. wide.

Leaves firm and rigid, 1-nerved; involucre 12-14 mm. high; flowers 5-7; mountains of Siskiyou, Modoc, and Butte Counties, Calif. 4a. var. *latior*

Leaves thin and lax, 1-nerved, many 3-nerved; involucre 9-10 mm. high; flowers 8-11; Mono Pass, Mono County, Calif. 4b. var. *Bolanderi*

Leaves narrow, linear, or spatulate, less than 4 mm. wide.

Upper leaves usually exceeding the flower cluster; heads solitary or two together, terminal or on short leafy twigs. 4c. var. *monocephalus*

Upper leaves rarely exceeding the flower cluster; heads few to numerous in racemes or narrow panicles.

Leaves spatulate or narrowly spatulate; gray with dense white hairs; involucral bracts sharply and abruptly short-pointed, white-hairy; San Bernardino Mountains, San Bernardino County, Calif. 4d. var. *imulus*

Leaves linear, green or grayish, sparsely to densely hairy and usually resinous-glandular; involucral bracts with long slender, erect or recurved tips; mostly eastern slope of the Sierra Nevada, California and western Nevada.

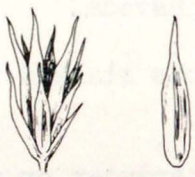
Leaves with numerous stalked resin glands, occasionally also slightly hairy. 4e. var. *asper*

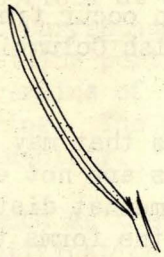
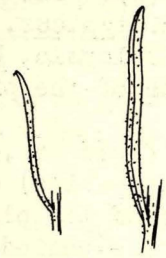
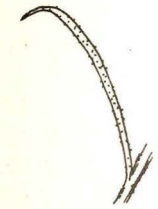
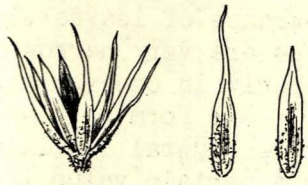
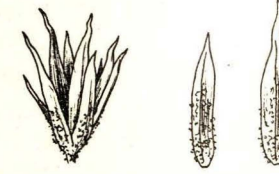
Leaves resinous-glandular or minutely viscid, glands not stalked; usually copiously or finely hairy.

Involucral bracts 13-20; flowers 4-6; eastern Sierra Nevada, Lassen County to Mono County, Calif., and western Nevada. 4f. var. *nevadensis*

Involucral bracts 9-12; flowers 5-7 or 8; southern Sierra Nevada from Mono County to Tulare County, Calif. 4g. var. *vulcanicus*

2. CHART DESCRIPTIONS OF CHRYSOTHAMNUS PARRYI VARIETIES

VARIETY	4a. *latior* (Hall)Jepson	4b. *Bolanderi* (Gray)Jepson	4c. *monocephalus* (Nels.& Ken.) Jepson	4d. *imulus* (Hall)Jepson
HABIT	Low shrub 16 inches high, with erect or ascending stems.	Low shrub 1 foot high, with erect stems from a much branched, bushy base.	Low shrub 2-12 inches high, with rigidly branched, spreading stems.	Low shrub 4 inches high; stems spreading at the base, the branches erect and leafy.
LEAVES	Elliptic or oblanceolate, 2.5-4.0 cm. long, 4.0-13.0 mm. wide, rigid, 1-nerved, dull green, obscurely finely hairy and minutely glandular-dotted; upper leaves shorter than the flower cluster.	Linear-oblanceolate, 3.0-4.0 cm. long, 4.0-5.0 mm. wide, thin and lax, 1-nerved or many 3-nerved, green, resinous-viscid and slightly glandular-hairy; upper leaves little reduced, and not exceeding the flower cluster.	Linear or spatulate, 1.0-3.0 cm. long, 1.5 mm. or less wide, 1-nerved, rarely 2-nerved, gray or green, sparsely to copiously hairy, also viscid; upper leaves usually exceeding the flower cluster.	Spatulate or narrowly spatulate, 1.0-1.5 cm. long, 2.0-3.0 mm. wide, 1-nerved, densely white-hairy; leaves not exceeding the flower cluster.
INFLORESCENCE	Heads in narrow terminal raceme-like panicles, interspersed with a few reduced leaves.	Heads crowded in short racemes, sometimes branched then appearing cymose.	Heads solitary or 2 together, terminal, or on short, leafy twigs.	Heads few, in a reduced raceme.
INVOLUCRE	12.0-14.0 mm. high; bracts 11-15, in 5 indistinct ranks, without hairs or slightly glandular-hairy with rigid, sharp, straight or recurved, spreading tips.	9.0-10.0 mm. high; bracts 11-15, obscurely ranked, minutely glandular; with straight, gradually narrowed tips. 	10.0-11.0 mm. high; bracts about 8-12; ranks obscure, sparsely to moderately hairy and slightly glandular; tapering to a straight, slender, prolonged point.	11.0-12.0 mm. high; bracts about 16, white-hairy, obscurely ranked, sharply and abruptly pointed, the outer tips sometimes green or reddish.
FLOWERS	5-7	8-11	5 or 6	11-15
DISTRIBUTION	Mountains; 3000-5400 feet elevation; California: Siskiyou, Modoc and Butte Counties.	Mountains; 8000-9000 feet elevation; California: Mono Pass, Mono County.	High mountains; 8000-9000 feet elevation; California: eastern side of the Sierra Nevada in Alpine, Tuolumne and Mono Counties; western Nevada.	6600 feet elevation; California: Known only from the San Bernardino Mountains, San Bernardino County.

VARIETY	4e. asper (Greene)Munz	4f. nevadensis (Gray)Jepson	4g. vulcanicus (Greene)Jepson
HABIT	Low shrub 6 inches or more high, with erect, or slightly spreading stems.	Low shrub 8-24 inches high, except in high mountain forms; stems erect or ascending.	Low shrub 6 inches or more high, with erect or ascending stems.
LEAVES	Linear, 2.0-4.0, or 5.0 cm. long, 1.0-4.0 mm. wide, 1-nerved, green, covered with numerous short stalked resin glands, occasionally slightly hairy; upper leaves scarcely equaling the flower cluster. 	Linear, 1.5-4.0 cm. long, 0.5-3.0 mm. wide, 1-nerved, either green or more commonly gray-green; copiously hairy or resinous-glandular; upper leaves seldom exceeding the flower cluster. 	Linear, 2.0-5.0 cm. long, 0.5-2.0 mm. wide, 1-nerved or obscurely 3-nerved, green or gray-green, hairy and minutely resinous-glandular, or at least minutely viscid; upper leaves scarcely equaling the flower cluster. 
INFLO-RESCENCE	Heads few in short racemes, or more numerous and the racemes longer.	Heads few to numerous in racemes or narrow panicles.	Heads numerous, in elongated often loose racemes or narrow panicles.
INVOLUCRE	11.0-12.0 mm. high; bracts 9-12, somewhat ranked, hairy and finely glandular; with straight, slender tips. 	12.0-15.0 mm. high; bracts usually 15-20, in more or less definite ranks, usually hairy and somewhat glandular, with long, slender tips which tend to recurve, all except the inner tips green.	11.0-13.0 mm. high; bracts 9-12, somewhat ranked, hairy and glandular; with straight or occasionally recurved slender prolonged tips, the tips occasionally green or reddish. 
FLOWERS	5-10	4-6	5-7, or occasionally 8
DISTRI-BUTION	Mountains; 7000-9000 feet elevation; California: Mono, Inyo, Tulare, and Ventura (Alamo Mountain) Counties.	High mountains to nearly timberline; 4500-9000 feet elevation; California: eastern Sierra Nevada from Lassen County to Mono County; western Nevada.	7000-10,000 feet elevation; California: southern Sierra Nevada, in Mono, Inyo, Madera, and Tulare Counties.

CHRYSOTHAMNUS NAUSEOSUS

This species comprises a multitude of forms, the identification of which becomes an extremely difficult problem. To as many as 47 segregates there has been accorded specific, subspecific, or varietal rank depending on the concept of the individual botanist. Hall and Clements recognize 20 subspecies in the United States (2). The typical form, which they denominate Chrysothamnus nauseosus subsp. typicus, is believed to occur from Assiniboia and Montana to South Dakota, Colorado, Utah, and British Columbia, and hence does not enter into the limits of the present paper.

Unfortunately for the field man, the characters that may be used to separate the varieties (or subspecies) of this species are not easily discernible in the field. The habit of the plants may be somewhat distinctive, but this elusive character cannot be relied upon because the forms the varieties assume are dependent to a large extent upon the habitat.

Geographic segregation of the varieties of Chrysothamnus nauseosus is practically impossible, for many of the varieties grow in the same locality. In some localities one variety may make up the entire population of the species at one end of its range but may overlap with other varieties at the other end of its range. Even though one variety may be rare and local, it may be associated with other varieties of the complex. Since Chrysothamnus nauseosus is a Great Basin species, the area of greatest admixture in our region occurs on the eastern slope of the Sierra Nevada from Lassen County south throughout Inyo County and the Mojave Desert of California and west central Nevada. Indeed all the varieties occur in some portion of this area and appear to spread outward from it.

The vegetative characters are usually unreliable. During certain seasons of the year the shrubs may be entirely leafless, the varieties then being indistinguishable, but even after the appearance of leaves their separation is difficult. In most specimens the leaves are very narrow or threadlike, and one-nerved. Occasionally, and particularly in one variety, the leaves tend to be broader, often up to 3 mm. or in one form to 7 mm. wide, with a suggestion of three nerves at the base. The general leafiness or sparsity of leaves within the flower cluster has a certain value in separating some of the varieties, but this holds true only for typical specimens.

One vegetative character which assumes importance and by which two varieties may be separated from the remainder of the complex is that of pubescence. Most of these shrubs exhibit twigs that are covered with close, compact, feltlike hairs. The twigs may be yellow-green, gray-green, or whitish. The leaves are gray-green with soft appressed hairs, or green and almost without hairs. In two of the varieties, however, the characteristics are quite different, the twigs being clothed with permanent, soft, loose, woolly hairs, which extend onto the leaves and often the involucres. Hence the shrubs appear white because of the persistence of these hairs, whereas in all the other varieties the shrubs assume a gray-green or greenish aspect.

The odor of the herbage is often a distinguishing feature, some varieties having a very strong disagreeable odor and others being almost inodorous.

Since the geographic distribution plays no part in the separation and the vegetative characters are only of minor importance, the flowers and the flower clusters afford more reliable characters. Without flower clusters it is almost impossible to determine the varieties of Chrysothamnus nauseosus accurately. This fact is particularly discouraging to the field worker who may be in the field at any season of the year. However, although the blooming season of Chrysothamnus is late compared with that of many other plants, this genus retains portions of the inflorescence long after blooming has ceased, and remains of the old inflorescences often persist until the next year's flowering. The old flowering stalks are often sufficient to indicate the plant's identity.

Inasmuch as the inflorescence and the flowers are the best means of accurate identification of the varieties of Chrysothamnus nauseosus, it is necessary to discuss their salient features and degrees of variation. The shape of the inflorescence is important. Most varieties exhibit a loose or compact, flat-topped or rounded cluster of flowers, termed a cyme. The other type of inflorescence, typical of one variety, is an elongated pyramidal cluster known as a thyrse; or occasionally the inflorescence may be cylindrical or globose. The cylindrical or globose type may be confused with the more compact, small, cyme types. When this occurs, however, other identifying features (described below) may be combined with the inflorescence character to separate the varieties.

Previous authors have stressed the importance of the involucres and their individual bracts, but an examination of many specimens indicates that the characters previously assigned to the involucres are relatively unimportant. The shape of the involucre is essentially uniform, although in typical specimens of one variety this structure appears more definitely five-angled. The presence or absence of hairs is a variable character, some involucres being densely woolly, and others almost without hairs except on the outer bracts. The same variety may have hairy as well as glandular-hairy involucres. Occasionally the involucres may be covered with a resinous exudation which gives the bracts a shining appearance. This type of exudation usually occurs with bracts lacking hairs except for a few glandular-ciliate hairs on the margins. Because of its variability, the pubescence of the bracts can be used as a distinguishing character only in certain instances.

The tip of the involucral bract has previously been given major importance in the separation of the varieties of Chrysothamnus nauseosus. Various manuals and monographs contain the statement that certain varieties have blunt bracts, whereas the bracts of others taper gradually to a point. One variety is separated from the remainder because of the abruptly pointed bract apex, while still another variety has a slender recurved tip about 1 mm. long. This last variety is the only one in which the characters of the bract retain any significance. Blunt, taper-pointed, and abruptly pointed bracts occur at random throughout the varieties, and they occur not only in the same variety but often within a single involucre. A few varieties tend to have only one type of bract, but this tendency is not sufficiently stable to afford complete separation.

The length of the involucre is unreliable as a distinguishing character. Measurements taken throughout many specimens show that there is much overlapping in size, the more robust forms tending to possess larger involucres, although there is no definite limitation in size.

The shape and size of the corolla lobes may be considered to be relatively constant differentiating characters. Three varieties have short, ovate, erect corolla lobes less than 1 mm. long, and the remaining five have corolla lobes which are narrow or lanceolate, and either spreading or recurved in age.

The hairiness of the corolla tube is a character of minor importance. Generally the tube is finely crisp-hairy, minutely hairy, or occasionally hairless. In two varieties, however, the hair on the tube is often cobwebby, relatively long, curly, and interwoven.

The comparative length of stigma and style appendage has been employed by previous authors to separate varieties. In general, two varieties with ovate corolla lobes have style appendages that are shorter than the stigmatic part. Measurements, however, showed that exceptions to this usual condition are common. Hence this feature is of only minor importance and, being difficult to judge in the field, is excluded from the present study.

The achenes are generally similar throughout the species. The body of the achene is densely soft-hairy in all but one variety which either lacks hairs entirely or has them only along the prominent ribs. The summit of the achene bears numerous pappus bristles that are either white or sordid.

From the foregoing review of the characters used to distinguish the varieties of Chrysothamnus nauseosus it is apparent that no single character may be depended upon to the exclusion of all others. It is only through a combination of characters that one may hope to arrive at an accurate determination of the several varieties.

It will be noted in the ensuing key that only eight varieties of the Chrysothamnus nauseosus complex are recognized as occurring in California and western Nevada, whereas previous authors have cited eleven or more. On the basis of careful examination of specimens certain varieties have been excluded because their supposedly distinguishing characters proved to be unstable. Thus it was found necessary to include vars. occidentalis, bernardinus, and macrophyllus with var. speciosus, and var. viridulus with var. consimilis.

Key to the Varieties of *Chrysothamnus nauseosus*

Chart 3, pp. 14-15

Foliage permanently and loosely woolly or hairy, wool nearly pure white on the twigs and leaves and often extending onto the involucres; corolla tube often cobwebby.

Herbage not fragrant; involucral bracts usually pointed; corolla lobes lanceolate, 1.5-2 mm. long. 5a. var. *albicaulis*

Herbage very fragrant; involucral bracts usually blunt; corolla lobes ovate, 0.5-1 mm. long. 5b. var. *hololeucus*

Foliage not permanently and loosely woolly or hairy; twigs and leaves usually gray, gray-green, or green, with close, compact, feltlike hairs; corolla tube with or without hairs, rarely cobwebby.

Inflorescence of loose or compact, rounded or flat-topped clusters.

Corolla lobes ovate, erect, less than 1 mm. long.

Leaves gray-green, soft-hairy; herbage fragrant; involucral bracts usually blunt, hairy, rarely glandular-hairy; achenes densely soft-hairy. 5c. var. *gnaphalodes*

Leaves green, hairless or minutely hairy; herbage not fragrant; involucral bracts usually sharp-pointed, glabrous or glandular-ciliate, occasionally glutinous; achenes hairless or occasionally hairy on the prominent ribs. 5d. var. *leiospermus*

Corolla lobes lanceolate, spreading at least in age, 1-2.5 mm. long.

Involucral bracts tipped with a slender recurved point about 1 mm. long; rare in the western Mojave Desert and Tejon Pass, Kern County, Calif. 5e. var. *ceruminosus*

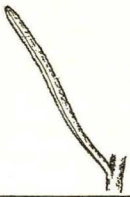
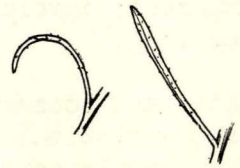
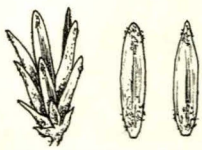
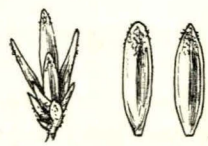
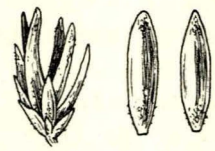
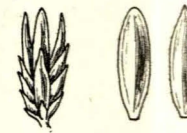
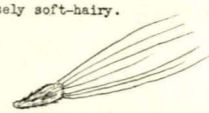
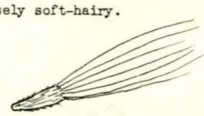
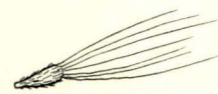
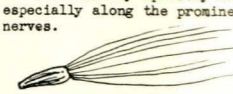
Involucral bracts sharp-pointed or tipped with a minute erect point less than 0.5 mm. long, or occasionally blunt; abundant.

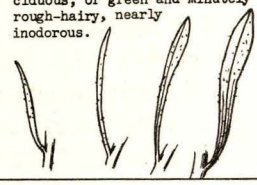
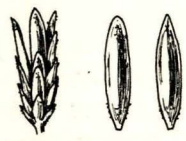
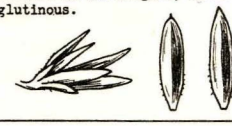
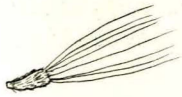
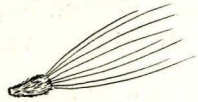
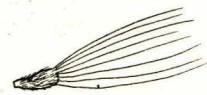
Stems usually leafless and rushlike especially near the inflorescence; involucre glutinous and hairless or rarely ciliate or glandular-hairy on the margins. 5f. var. *mohavensis*

Stems usually densely leafy up to the inflorescence, rarely leafless and rushlike; involucre hairy or glandular-hairy, never glutinous; inner bracts occasionally hairless. 5g. var. *speciosus*

Inflorescence elongate, pyramidal, or cylindrical, rarely of globose clusters. 5h. var. *consimilis*

3. CHART DESCRIPTIONS OF CHRYSOTHAMNUS NAUSEOSUS VARIETIES

VARIETY	5a. albicaulis (Nutt.)Rydb.	5b. hololeucus (Gray)Hall	5c. gnaphalodes (Greene)Hall	5d. leiospermus (Gray)Hall
HABIT	Bushy, rounded shrub, 2-3½ feet high; twigs erect, leafy to the top, not striate, densely and permanently white with loose, soft, woolly hairs.	Broad, rounded, closely branched shrub, 2-6 feet high; twigs erect, leafy to the top, not striate, permanently white with loose, soft, woolly hairs.	Rounded shrub, 2-5 or 8 feet high; with many short, twiggy branches; twigs erect or spreading, not densely leafy, obscurely striate; covered with gray or yellowish-green, compact, felt-like hairs.	Low shrub, 1-3 feet high, with erect branches; twigs many, crowded, erect, moderately leafy or naked, scarcely striate, covered with yellowish-green to white, compact, feltlike hairs.
LEAVES	Narrowly linear, 2.5-4.0 cm. long, 0.5-1.5 mm. or to 3.0 mm. wide; herbage permanently white with loose, soft, woolly hairs, not fragrant. 	Linear, 1.0-3.0 cm. long, 1.0 or nearly 2.0 mm. wide, herbage permanently white with loose, soft, woolly hairs, very fragrant.	Narrowly linear, 2.0-4.0 cm. long, 1.0 mm. or less wide, those of the end twigs only 1.0-3.0 cm. long, often recurved; herbage with gray, soft hairs, very fragrant. 	Threadlike or nearly so, 0.5-2.0 or 3.0 cm. long, less than 0.5 mm. wide, often reduced and scale-like; herbage soft-hairy, or green and essentially without hairs, inodorous.
INFLORESCENCE	Rounded loose clusters.	Compact rounded clusters.	Rounded clusters terminating each of the twigs.	Dense rounded or flat-topped terminal clusters.
INVOLUCRE	7.0-9.0 mm. high; bracts usually sharp-pointed, mostly white-woolly. 	6.0-7.0 mm. high; bracts usually very blunt, mostly white-woolly-hairy. 	6.0-8.0 mm. high; bracts usually blunt, soft-hairy, rarely glandular-hairy. 	6.0-8.0 mm. high; bracts blunt or sharp-pointed, without hairs or glandular-ciliate, occasionally glutinous. 
COROLLA	8.0-10.0 mm. long; tube cobwebby-hairy; lobes lanceolate, 1.5-2.0 mm. long.	6.5-8.0 mm. long; tube minutely hairy, or usually more or less cobwebby; lobes ovate, erect, 0.5-1.0 mm. long.	7.0-8.0 mm. long; tube with sparse, short, crisp hairs; lobes ovate, 0.5-1.0 mm. long, erect or lightly appressed to the stamen tube.	5.0-8.0 mm. long; tube obscurely hairy; lobes ovate, erect, 0.5 mm. or less long.
ACHENES	Densely soft-hairy. 	Densely soft-hairy. 	Densely soft-hairy. 	Without hairs in typical form, but occasionally sparsely hairy, especially along the prominent nerves. 
DISTRIBUTION	Dry upland slopes and benches; California: eastern side of the Sierra Nevada, from Modoc County south to Mono County; middle-western Nevada.	Gravelly or sandy, well-drained slopes; 4800-5700 feet elevation; California: eastern side of the Sierra Nevada, from Mono County southward in Inyo County and southwest to Antelope Valley in the western Mohave Desert; western Nevada north to Pyramid Lake.	Abundant on gravelly or sandy, non-alkaline slopes and benches; California: eastern side of the Sierra Nevada from Mono County south in Inyo County to the western Mohave Desert and occasionally on the western edge of the Colorado Desert and on mesas near Colton, San Bernardino County.	On exceedingly arid slopes; California: Providence and Clark Mountains, San Bernardino County; west-central Nevada.

VARIETY	5e. ceruminosus (D. & H.)Hall	5f. mohavensis (Greene)Hall	5g. speciosus (Nutt.)Hall	5h. consimilis (Greene)Hall
HABIT	Rounded, fastigiately branched shrub, 1 3/4-5 feet high, twigs erect, sparsely short leafy, striate, yellowish-green with soft, compact feltlike hairs.	Shrub 3-5 feet high, with elongated, straight stems; twigs erect, or ascending, often leafless and rushlike, striate, white or greenish-yellow with soft, compact feltlike hairs.	Broad, rounded, tall or low shrub, 1-6 feet high; twigs erect or ascending, leafy to summit, obscurely striate, covered with gray or greenish-white, compact feltlike hairs.	Tall, erect shrub, 2-5 feet high, with erect or ascending branches; twigs erect, moderately leafy, striate, covered with yellowish-green, compact feltlike hairs.
LEAVES	Narrowly linear, almost threadlike, 1.0-3.0 cm. long, usually less than 1.0 mm. wide, herbage finely soft-hairy, scarcely odorous.	Narrowly linear to threadlike, 2.0-3.0 cm. long; finely soft-hairy or without hairs.	Linear, 2.0-6.0 cm. long, about 1.0 mm. wide, varying to 6.5 mm., erect or ascending, usually dense toward the inflorescence; herbage gray-green with grayish, soft hairs, or hairs partly deciduous, or green and minutely rough-hairy, nearly inodorous. 	Narrowly linear or nearly threadlike, 2.5-5.0 cm. long, to 1.0 mm. wide; herbage green, finely white-hairy to almost without hairs and somewhat resinous, malodorous.
INFLORESCENCE	Compact rounded clusters.	Loose or compact rounded or flat-topped clusters.	Loose or compact rounded or flat-topped clusters.	Usually elongated pyramidal, or occasionally cylindric to nearly globose clusters.
INVOLUCRE	7.0-8.0 mm. high; bracts abruptly narrowed to a threadlike recurved point about 1.0 mm. long, glutinous and usually without hairs.	9.0-10.5 mm. high; bracts blunt or pointed, without hairs, glutinous, rarely ciliate or glandular-hairy on the margins. 	8.0-13.0 mm. high; bracts gradually pointed or with an abrupt minute point, finely soft-hairy or all but the outer ones without hairs, glandular-hairy or ciliate on the margins; never glutinous. 	6.5-8.5 mm. high; bracts pointed, or occasionally blunt, with or without hairs, glandular-hairy or merely glutinous.
COROLLA	6.5 mm. long; tube minutely soft-hairy; lobes 1.5-2.0 mm. long.	8.0-10.0 mm. long; tube minutely soft-hairy; lobes 1.5-2.5 mm. long, spreading.	8.0-12.0 mm. long; tube sparsely finely hairy or without hairs; lobes narrow, 0.8-2.5 mm. long.	5.0-9.5 mm. long; tube without hairs, or obscurely minutely hairy; lobes narrow, 1-2.5 mm. long, spreading or recurving in age.
ACHENES	Densely soft-hairy. 	Densely soft-hairy. 	Densely soft-hairy. 	Densely soft-hairy.
DISTRIBUTION	California: rare in the western Mohave Desert and vicinity of Tejon Pass, Kern County.	Well-drained, scarcely alkaline soil; below 7000 feet elevation; California: western Mohave Desert northward in the inner South Coast Ranges to the Mount Hamilton region.	Moderately alkaline, dry sandy, clayey or rocky slopes; 500-9500 feet elevation; California: eastern side of the Sierra Nevada, Modoc County south to Mono County; eastern Mohave Desert, San Bernardino, San Jacinto and San Gabriel Mountains of southern California, Mount Pinos, Ventura County, north to the inner North Coast Ranges, eastward to Siskiyou County, and occasionally on the western slope of the Sierra Nevada; western Nevada.	Dry alkaline valleys and plains; 3000-7000 feet elevation; California: Siskiyou County east to Modoc County, and south along the east side of the Sierra Nevada, south to the desert side of the San Bernardino Mountains; west-central Nevada.

CHRYSOTHAMNUS NAUSEOSUS var. ALBICAULIS
CHRYSOTHAMNUS NAUSEOSUS var. HOLOLEUCUS

The two varieties cited above are closely similar in their persistent white woolly herbage, which also readily distinguishes them from all other varieties of the species. In the field it may be noted that in var. albicaulis the herbage is not fragrant, whereas that of var. hololeucus is very fragrant. On close examination of the flowers it will be noted that the main difference is in the corolla lobes, those of var. albicaulis being long and narrow and those of var. hololeucus short and ovate.

The ranges of the two species overlap. In plotting specimen localities on a map (see Distribution Map 3, p. 33), however, it is apparent that var. albicaulis is more abundant in the northern part of the range. The occurrence of an isolated locality of var. hololeucus in Santa Barbara Canyon (Yates 6394) is difficult to explain. Although the specimen is immature it matches typical specimens of this variety collected in Inyo County and western Nevada.

CHRYSOTHAMNUS NAUSEOSUS var. GNAPHALODES

Variety gnaphalodes typically presents a distinct aspect at the flowering period, primarily because of its very short, moderately dense, recurved leaves on the upper portions of the twigs and in the inflorescence. However, this is not always true, inasmuch as some specimens have long leaves in the inflorescence, and others are almost leafless. The shrubs are usually grayish-green or occasionally green in appearance. As in var. hololeucus the corolla lobes are ovate, but the close, compact, feltlike hairs on the twigs afford a means of separation.

CHRYSOTHAMNUS NAUSEOSUS var. LEIOSPERMUS

This variety is quite distinct from vars. gnaphalodes and hololeucus, although it possesses short ovate corolla lobes. The latter variety is separable from var. leiospermus by its persistent white woolly hairs, inasmuch as var. leiospermus is green or slightly gray-green in color. The leaves in the inflorescence are not short and recurved and are either moderately dense or, more commonly, almost completely lacking; the foliage is never as grayish as that of var. gnaphalodes; and the herbage is scentless, whereas that of var. gnaphalodes is very fragrant. The most reliable difference is that the achenes are hairless or, if hairs are present, they are limited to the prominent ribs of the achene.

As indicated by the map (see Distribution Map 3, p. 33), this variety is nowhere abundant and occurs locally in widely separate localities.

CHRYSOTHAMNUS NAUSEOSUS var. CERUMINOSUS

The involucral bracts of var. ceruminosus bear at the apex a long recurved point about 1 mm. or more long. In other respects it most nearly resembles var. mohavensis but may be separated from it by the bract character. This rare variety is known only in two localities. (See specimens to verify range, p. 25, and Distribution Map 3, p. 33.)

CHRYSOTHAMNUS NAUSEOSUS var. MOHAVENSIS

Variety mohavensis (in typical form) is easily separable from var. speciosus because the shrubs are sparsely leafy or leafless and rushlike, particularly in the inflorescence, while in var. speciosus they are usually densely leafy to the inflorescence. The involucral bracts of var. mohavensis tend to aline in more definite rows than those of var. speciosus, thus causing the involucre to appear five-angled.

It is more difficult to distinguish between less typical forms of the two varieties. Some forms of var. mohavensis may be somewhat leafy in the inflorescence, while leaves are occasionally sparse in var. speciosus. The involucral bracts of var. mohavensis, however, are usually hairless and covered with a resinous exudation, at least at the base, and, if hairs are present, they occur only along the margins of the bracts as glandular cilia. In var. speciosus the bracts are hairy, glandular-hairy, or rarely hairless, but in the last, the bracts are not glutinous as in var. mohavensis. The glandular hairs of var. speciosus are not limited to the margins of the bracts.

Variety mohavensis is most abundant in areas where var. speciosus does not occur, and it is only on the margins of its range that the two overlap and cause confusion. (See Distribution Map 3, p. 33.)

CHRYSOTHAMNUS NAUSEOSUS var. SPECIOSUS

Variety speciosus as recognized here includes a number of forms that have previously been considered separate entities. The characters supposed to delimit these forms, however, cannot be relied upon because there is much overlapping and no one character is varietally delimiting. The description of this variety has been somewhat expanded to include vars. occidentalis. speciosus, bernardinus, and macrophyllus.

Geographically, the var. speciosus is the most abundant form of Chrysothamnus nauseosus in California and western Nevada, particularly on both eastern and western slopes of the Sierra Nevada and in the north Coast Ranges. Localities in the south Coast Ranges are few, but the variety recurs rather commonly in the San Antonio, San Jacinto, and San Bernardino Mountains of southern California. (See Distribution Map 3, p. 33.)

CHRYSOTHAMNUS NAUSEOSUS var. CONSIMILIS

Variety consimilis is typically quite different from the others because of its elongated inflorescence. Occasionally, however, the inflorescence may be small, compact, and globose, which may cause it to be confused with some forms of var. speciosus. The herbage of the var. consimilis is, however, malodorous, and that of var. speciosus is scarcely scented. In general, also, the involucral bracts of var. consimilis are glutinous, particularly so just below the involucres, while those of var. speciosus may be glandular but are very rarely glutinous.

Some writers have recognized the var. viridulus as a distinct entity chiefly because of its stouter habit and longer flowers and corolla lobes. Forms of this variety occur with the stouter habit but with flowers and corolla lobes measuring exactly the same as those of var. consimilis. Hence it is thought best to include these plants with var. consimilis, since all show elongated inflorescence. Stouter shrubs with a tendency to longer flowers and corolla lobes and more glutinous bracts occur more commonly in the southern portion of the range of var. consimilis.

C. viscidiflorus also presents a series of polymorphic forms that have been treated variously by different botanists. Hall and Clements remarked: "From this assemblage of forms there have been published from time to time a total of 20 segregates, 16 of which have been accorded specific rank by those who use the narrow species concept. Even after these 17 proposals have been reduced to 10 subspecies, it is found that they pass so insensibly from one to another that they cannot be satisfactorily defined" (2). Hall and Clements attribute 6 subspecies to our area of California and western Nevada.

The segregation of these varieties has been largely on the bases of stature, width of leaves, and pubescence, all of which are so variable that delimitation of varieties is almost impossible. Geographic distribution is of little help, since the ranges of the forms overlap considerably. In this paper the forms of Chrysothamnus viscidiflorus have been reduced to three, which may be separated by the following key:

Key to the Varieties of Chrysothamnus viscidiflorus

Chart 4, p. 19

Shrubs usually tall, 2-4 feet high; leaves broadly linear to broadly lanceolate or elliptic, 2-12 mm. wide, rarely less than 2 mm. wide, usually three- to five-nerved. 6a. C. viscidiflorus (typical form)

Shrubs low, 1/4 to 1-2/3 feet high; leaves linear to almost threadlike, 1-2 mm., often less than 1 mm. wide, one-nerved or occasionally three-nerved.

Leaves not finely hairy, viscidulous; branches of the inflorescence without hairs. 6b. var. pumilus

Leaves densely and finely hairy, not viscidulous; branches of the inflorescence finely hairy. 6c. var. puberulus

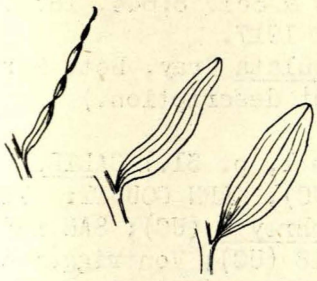
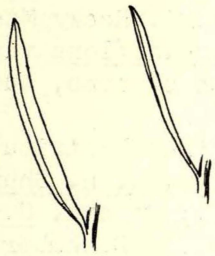
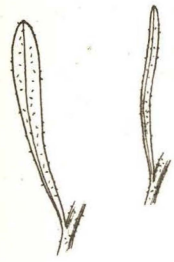
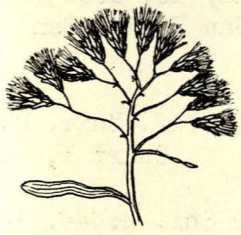
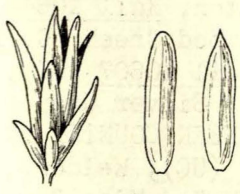
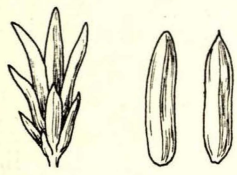
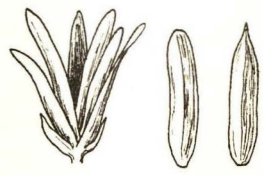
CHRYSOTHAMNUS VISCIDIFLORUS (typical form)

Chrysothamnus viscidiflorus is typically a tall shrub with narrow to broad leaves, which are hairless and viscidulous or which have fine rough hairs only on the margins. Variety latifolius was segregated by Greene in 1895, because of its broad leaves, but measurements taken on many specimens reveal so much overlapping that it seems unwise to retain the broad-leaved form as a variety.

CHRYSOTHAMNUS VISCIDIFLORUS var. PUBERULUS
CHRYSOTHAMNUS VISCIDIFLORUS var. PUMILUS

Varieties pumilus and puberulus may be considered to be dwarfed, usually narrow-leaved forms of C. viscidiflorus. Variety puberulus has finely hairy leaves and branchlets, while variety pumilus has no hairs on the leaves and branchlets. Two other dwarfed forms have been recognized, but here again the degree of overlapping is so great that it is almost impossible to separate them: var. stenophyllus, with very narrow hairless leaves, is indistinguishable from var. pumilus, and var. humilus, with finely hairy leaves and branchlets, cannot be readily separated from var. puberulus.

4. CHART DESCRIPTIONS OF THE CHRYSOTHAMNUS VISCIDIFLORUS VARIETIES

VARIETY	6a. viscidiflorus Nutt. (Typical Form)	6b. pumilus (Nutt.)Jepson	6c. puberulus (D. C. Eaton)Jepson
HABIT	Tall shrubs 2-4 feet high.	Low shrubs 4-20 inches high.	Low shrubs 4-20 inches high.
LEAVES	Broadly linear to broadly lanceolate or elliptic, 2-5 cm. long, 2-12 mm. wide, 1-nerved or often 3-5-nerved, flat or twisted, bright green or bluish-green, viscid or not densely so, without hairs, or rarely with hairs, often glutinous. 	Linear to almost threadlike, 1-4 cm. long, 1-2 mm. wide or less than 1 mm. wide, 1-nerved or often 3-nerved, flat or twisted, bright to pale green, viscidulous or glandular, the margins often rough and rolled inward, leaf surfaces without hairs. 	Linear or slightly oblanceolate, 1.5-4 cm. long, 1-2 mm. or often less than 1 mm. wide, 1-nerved, flat or twisted, the margins often rolled inward, pale grayish-green, densely and finely soft- or rough-hairy. 
INFLO-RESCENCE	Broad, open, lax or small, dense clusters, the branches usually without hairs, often glutinous. 	Small, compact or sometimes lax clusters, the branches without hairs.	Small, compact, or occasionally looser, clusters, the branches finely hairy.
INVOLUCRE	5-8 mm. high; bracts boat-shaped, blunt, but commonly tipped with a short point. 	4-7 mm. high; bracts oblong or narrower, blunt or abruptly pointed. 	6-7 mm. high; bracts oblong, blunt or the outer pointed. 
DISTRI-BUTION	Dry slopes and benches; 5400-8600 feet elevation; California: northern and eastern slopes of the Sierra Nevada, Siskiyou County to Inyo County, south to the Santa Rosa and San Jacinto mountains; western Nevada.	6000-8000 feet elevation; California: San Bernardino Mountains; Mount Pinos, Ventura County; eastern side of the Sierra Nevada; western Nevada.	Dry sandy situations and arid valleys; 5000-6000 feet elevation; California: eastern Nevada County, Mono County, Inyo County; western Nevada.

SYNONYMY AND SPECIMENS TO VERIFY RANGE[3/]

1. CHRYSOTHAMNUS PANICULATUS (Gray) Hall, Calif. Univ. Pub. Bot. 3: 58. 1907. Chart 1, p. 4

Bigelovia paniculata Gray, Proc. Amer. Acad. Arts & Sci. 8:644. 1873.
Ericameria paniculata Rydb. Fl. Rocky Mts. 853, 1917.
Linosyris (Chrysothamnus) viscidiflora var. paniculata Gray, Bot. Mex. Bound. 80. 1859. (First publication of name, but without description.)

SPECIMENS TO VERIFY RANGE: (See Distribution Map 1, p. 31.) CALIFORNIA: INYO COUNTY: Pahrump Valley, A. H. Shunk 12 (UC); KERN COUNTY: Tehachapi Pass, C. B. Wolf 2613 (UC); Mojave, C. J. Humphrey 5 (UC); SAN BERNARDINO COUNTY: Barstow, H. M. Hall, December 24, 1918 (UC); Vontrigger Spring, P. A. Munz 13899 (UC); Baker, Susan Hutchinson 5608 (UC); Bagdad, T. S. Brandegee, May 20, 1902 (UC); RIVERSIDE COUNTY: Mission Canyon, Lewis S. Rose 34496 (UC); Chuckawalla Bench, E. E. Schellenger 19 (UC); Cabazon, Schellenger 43 (UC); Palm Springs, M. E. Jones, May 10, 1903 (UC); White-water Wash, Rose 35677 (UC); SAN DIEGO COUNTY: San Felipe Canyon, Frank W. Peirson 12638 (UC).

2. CHRYSOTHAMNUS TERETIFOLIUS (Dur. & Hilg.) Hall, Calif. Univ. Pub. Bot. 3:57, 1907. Chart 1, p. 4

Bigelovia teretifolia Gray, Proc. Amer. Acad. Arts & Sci. 8:644. 1873.
Ericameria teretifolia Jepson, Man. Fl. Pl. Calif. 1024. 1925.
Linosyris teretifolia Durand & Hilgard, Jour. Acad. Nat. Sci. Phila. II, 3:41. 1855.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 1, p. 31.) CALIFORNIA: MONO COUNTY: Benton Range, Hall 10645 (UC); Benton, Hall 10644 (UC); Rock Creek, Wolf 2509 (UC); INYO COUNTY: Cottonwood Creek, C. A. Purpus 3060 (UC); Bishop, Hall 10620 (UC); Oak Creek, Hall 10607 (UC); Payson Canyon, Hall 10821 (UC); Owenyo, Hall 10681 (UC); Silver Canyon, Hall 10679 (UC); Haiwee Creek, R. W. Lundh 73 (VTM); KERN COUNTY: Tehachapi Pass, Wolf 2608 (UC); Rosamond Hills, Hall 10572 (UC); Weldon, Helen-Mar Wheeler, June 27, 1932 (UC); LOS ANGELES COUNTY: Mint Canyon, Wolf 2505 (UC); SAN BERNARDINO COUNTY: Warrens Well, D. D. Keck 236 (UC); Fifteenmile Point, D. Axelrod 379 (VTM); RIVERSIDE COUNTY: Santa Rosa Mountains, Munz 12872 (UC); Optimist Mine Road, James E. Cole 929 (UC); WESTERN NEVADA: ESMERALDA COUNTY: Lida, Hall 10817 (UC); Candelaria, Hall 10667 (UC).

3/ Each specimen cited is followed by the designation UC or VTM. UC refers to the University of California Herbarium, Berkeley, and VTM refers to the Vegetation Type Map Herbarium, Berkeley, wherein the specimens are housed.

3. CHRYSOTHAMNUS ALBIDUS (Jones) Greene, Erythea 3:107. 1895.
Chart 1, p. 4

Bigelovia albida Jones ex Gray, Proc. Amer. Acad. Arts & Sci. 17:209. 1882.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 1, p. 31.) CALIFORNIA: INYO COUNTY: Shoshone, Wolf 7678 (UC); WESTERN NEVADA: WASHOE COUNTY: Pyramid, T. M. Hendrix 887A (VTM,UC); STOREY COUNTY: Clarks, R. W. Saarni 231 (VTM).

4a. CHRYSOTHAMNUS PARRYI (Gray) Greene var. LATIOR (Hall & Clem.) Jepson, Man. Fl. Pl. Calif. 1033. 1925. Chart 2, p. 8

Chrysothamnus Parryi subsp. latior Hall & Clem. Carnegie Inst. Wash. Pub. 326:199. 1923.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 2, p. 32.) CALIFORNIA: SISKIYOU COUNTY: Wagnon Creek, A. A. Heller 12250 (UC); Sisson, Geo. B. Grant 5152 (UC); Mt. Eddy, Alice Eastwood 2079 (UC); MODOC COUNTY: Little Hot Spring Valley, M. S. Baker, August 18, 1899 (UC); BUTTE COUNTY: Humboldt Road, H. F. Copeland, August 17, 1932 (UC).

4b. CHRYSOTHAMNUS PARRYI var. BOLANDERI (Gray) Jepson, Man. Fl. Pl. Calif. 1033. 1925. Chart 2, p. 8

Bigelovia Bolanderi Gray, Proc. Amer. Acad. Arts & Sci. 8:641. 1873
Chrysothamnus Bolanderi Greene, Erythea 3:114. 1895.
Chrysothamnus Parryi subsp. Bolanderi Hall & Clem. Carnegie Inst. Wash. Pub. 326:199. 1923.
Linosyris Bolanderi Gray, Proc. Amer. Acad. Arts & Sci. 7:354. 1868
Macronema Bolanderi Greene, Leaflets 1:81. 1904.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 2, p. 32.) CALIFORNIA: MONO COUNTY: Mono Pass, H. N. Bolander 6137 (UC).

4c. CHRYSOTHAMNUS PARRYI var. MONOCEPHALUS (Nels. & Ken.) Jepson, Man. Fl. Pl. Calif. 1033. 1925. Chart 2, p. 8

Chrysothamnus monocephalus Nelson and Kennedy, Proc. Biol. Soc. Wash. 19:39. 1906.
Chrysothamnus nevadensis forma monocephalus Smiley, Calif. Univ. Pub. Bot. 9:357. 1921.
Chrysothamnus Parryi subsp. monocephalus Hall & Clem. Carnegie Inst. Wash. Pub. 326:200. 1925.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 2, p. 32) CALIFORNIA: ALPINE COUNTY: Sonora Peak, H. S. Yates 6220 (VTM); TUOLUMNE COUNTY: Sonora Pass, W. A. Peterson 498 (VTM, UC); Between Soldier and Spiller Lakes, A. H. Hawbecker, August 15, 1936 (VTM); MONO COUNTY: Mt. Conness, J. Clausen 1653 (UC); Black Mountain, Hendrix 620 (VTM, UC); Ellery Lake Dam, Wolf 2549 (UC); Belfort, G. A. Graham 150 (VTM, UC); Jessie Lake, J. W. Congdon, August 12, 1898 (UC); Bloody Canyon, Congdon, August 16, 1894 (UC); Lundy, Maud Minthorn 224 (UC); Sonora Peak, A. D. Gifford 771 (VTM); WESTERN NEVADA: WASHOE COUNTY: Mt. Rose, Heller 9976 (UC).

4d. CHRYSOTHAMNUS PARRYI var. IMULUS (Hall) Jepson, Man. Fl. Pl. Calif. 1033. 1925. Chart 2, p. 8

Chrysothamnus Parryi subsp. imulus Hall & Clem. Carnegie Inst. Wash. Pub. 326:200. 1923.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 2, p. 32.) CALIFORNIA: SAN BERNARDINO COUNTY: Bear Valley, A. Davidson 1896; Jones, July 19, 1900 (UC).

4e. CHRYSOTHAMNUS PARRYI var. ASPER (Greene) Munz, Man. So. Calif. Bot. 524. 1935. Chart 2, p. 8

Chrysothamnus asper Greene, Leaflets 1:80. 1904.
Chrysothamnus Parryi subsp. asper Hall & Clem. Carnegie Inst. Wash. Pub. 326:200. 1923.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 2, p. 32.) CALIFORNIA: MONO COUNTY: Bloody Canyon, Congdon, August 13, 1898 (UC); INYO COUNTY: east slope of the Sierra Nevada, Coville & Funston 1690 (UC); VENTURA COUNTY: Alamo Mountain, Hall 6701 (UC).

4f. CHRYSOTHAMNUS PARRYI var. NEVADENSIS (Gray) Jepson, Man. Fl. Pl. Calif. 1032. 1925. Chart 2, p. 9

Bigelovia Howardi var. nevadensis Gray, Proc. Amer. Acad. Arts & Sci. 8:641. 1873.
Bigelovia nevadensis Gray, Syn. Fl. 12:136. 1884.
Chrysothamnus nevadensis Greene, Erythea 3:114. 1895.
Chrysothamnus Parryi subsp. nevadensis Hall & Clem. Carnegie Inst. Wash. Pub. 326:201. 1923.
Linosyris Howardi var. nevadensis Gray, Proc. Amer. Acad. Arts & Sci. 6:541. 1865.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 2, p. 32.) CALIFORNIA: LASSEN COUNTY: Janesville, Wolf 2405 (UC); PLUMAS COUNTY: Keddie, I. M. Johnston 2183 (UC); Portola, Johnston 2180 (UC); Grizzly Peak, C. G. Albertus 260 (VTM, UC); NEVADA COUNTY: Truckee, Heller 7188 (UC); ALPINE COUNTY: Ebbett's Pass, W. H. Brewer 1985 (UC); MONO COUNTY: Benton, Edmund Jaeger, September 10, 1939 (UC); Bridgeport, G. A. Graham 166 (VTM, UC); Simpson, Graham 114 (VTM); Mormon Ranch, Hendrix 624 (VTM); WESTERN NEVADA: WASHOE COUNTY: Spanish Springs Valley, P. B. Kennedy 1950 (UC); Reno, Hall 11684 (UC); Verdi, Kennedy 943 (UC); Thomas Creek, Hall 12146 (UC); Five Mile House, T. C. Adams 118 (VTM, UC) Tule Peak, B. Bolt 810 (VTM); Peavine Mountain, Heller 10675 (UC); Franktown, Kennedy 1934 (UC); ORMSBY COUNTY: King's Canyon, C. F. Baker 1503 (UC); LYON COUNTY: Rockland, Hendrix 707 (VTM, UC); DOUGLAS COUNTY: Como Peak, V. Stackhouse 40 (VTM. UC); Mineral Peak, D. Tillotson 271 (VTM).

4g. CHRYSOTHAMNUS PARRYI var. VULCANICUS (Greene) Jepson, Man. Fl. Pl. Calif. 1033. 1925. Chart 2, p. 9

Chrysothamnus nevadensis var. vulcanicus Smiley, Calif. Univ. Pub. Bot. 9:357. 1921.
Chrysothamnus Parryi subsp. vulcanicus Hall & Clem. Carnegie Inst. Wash. Pub. 326:200. 1923.
Chrysothamnus vulcanicus Greene, Leaflets 1:80. 1904.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 2, p. 32.) CALIFORNIA: MONO COUNTY: Mono Mills, Hall 10844 (UC); Pumice Valley, Hall 10903 (UC); Near Bridgeport, Hall 12130 (UC); Mount Biedman, Gifford 902 (VTM, UC); Bloody Canyon, Congdon, August 16, 1895 (UC); MADERA COUNTY: Upper San Joaquin, Congdon, August 19, 1895 (UC); Soda Springs, Congdon, August 20, 1895 (UC); Sotcher Lake, Hall 11886 (UC); TULARE COUNTY: Little Kern River, Purpus 2055 (UC); Volcano Meadows, Hall & Babcock 5496 (UC); Golden Trout Creek, H. M. & G. R. Hall 8413 (UC).

5. CHRYSOTHAMNUS NAUSEOSUS (Pall.) Britt. ex Britton and Brown, Ill. Fl. 3:326. 1898 Chart 1, p. 5

Chrysocoma nauseosa Pallas ex Pursh, Fl. Amer. Sept. 2:517. 1814.

5a. CHRYSOTHAMNUS NAUSEOSUS var. ALBICAULIS (Nutt.) Rydb. Mem. N. Y. Bot. Gard. 1:385, 1900. Chart 3, p. 14

Bigelovia graveolens Gray var. albicaulis Gray, Proc. Amer. Acad. Arts & Sci. 8:645. 1873.
Chrysothamnus californicus Greene, Erythea 3:111. 1895.
Chrysothamnus nauseosus subsp. albicaulis Hall & Clem. Carnegie Inst. Wash. Pub. 326:212. 1925.
Chrysothamnus nauseosus var. californicus Hall, Calif. Univ. Pub. Bot. 7:174. 1919.
Chrysothamnus orthophyllus Greene, Pittonia 5:62. 1902.
Chrysothamnus speciosus β albicaulis Nutt. Trans. Amer. Phil. Soc. II, 7:324. 1840.
Linosyris albicaulis Torr. & Gray, Fl. N. Amer. 2:234. 1842.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 3, p. 33.) CALIFORNIA: MODOC COUNTY: 1 mile from Oregon Line, Hall 11662 (UC); LASSEN COUNTY: Honey Lake Valley, Hall 11681 (UC); PLUMAS COUNTY: Grizzly Peak, Albertus 278 (VTM); NEVADA COUNTY: Truckee, Heller 7192 (UC); PLACER COUNTY: Mt. Mildred, Bolt 199 (VTM); MONO COUNTY: west of Mono Lake, Hall 10853 (UC); WESTERN NEVADA: WASHOE COUNTY: Near Reno, K. Brandegee, August, 1883 (UC); Franktown, K. E. Bradshaw 209 (VTM, UC).

5b. CHRYSOTHAMNUS NAUSEOSUS var. HOLOLEUCUS (Gray) Hall, Calif. Univ. Pub. Bot. 7:166. 1919. Chart 3, p. 14

Bigelovia graveolens var. hololeuca Gray, Proc. Amer. Acad. Arts & Sci. 8:645. 1873.
Chrysothamnus nauseosus subsp. hololeucus Hall & Clem. Carnegie Inst. Wash. Pub. 326:211. 1923.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 3, p. 33.) CALIFORNIA: MONO COUNTY: Benton, Hall 233 (UC); INYO COUNTY: Bishop Creek, Hall 10621 (UC); Independence, Hall 10615 (UC); Oak Creek, Hall 10610 (UC); SANTA BARBARA COUNTY: Santa Barbara Canyon, Yates 6349 (VTM); WESTERN NEVADA: WASHOE COUNTY: Pyramid Lake, Hall 10884 (UC); Indian Rock, Hendrix 888 (VTM); LYON COUNTY: Toll, Stackhouse 67 (VTM, UC); ESMERALDA COUNTY: Lida, Hall 10818 (UC).

5c. CHRYSOTHAMNUS NAUSEOSUS var. GNAPHALODES (Greene) Hall, Calif. Univ. Pub. Bot. 7:167. 1919. Chart 3, p. 14

Chrysothamnus gnaphalodes Greene, Pittonia 4:42. 1899.
Chrysothamnus nauseosus subsp. gnaphalodes Hall & Clem. Carnegie Inst. Wash. Pub. 326:211. 1923.
Chrysothamnus speciosus var. gnaphalodes Greene, Erythea 3:110. 1895.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 3, p. 33.) CALIFORNIA: LASSEN COUNTY: Eastern Lassen County, Hall 11676 (UC); MONO COUNTY: Benton, Hall 10623 (UC); Rock Creek, Wolf 2510 (UC); INYO COUNTY: Bishop, Hall 10623 (UC); Haiwee, Hall 10592 (UC); Cartago, Hall 10595 (UC); Silver Canyon, White Mountains, Hall 10631 (UC); Independence, Hall 10617 (UC); Kearsarge, Hall 10597 (UC); Oak Creek, Hall 10612 (UC); KERN COUNTY: Rosamund, J. Burtt Davy 2941 (UC); Mojave, Hall 10568 (UC); VENTURA COUNTY: Sycamore Canyon, N. French 345 (VTM); Hungry Valley, Peterson 2 (VTM); LOS ANGELES COUNTY: Saugus, Frank W. Hubby, December 8, 1894 (UC); Lancaster, Hall 10577 (UC); Quail Lake, G. E. Sindel 101 (VTM); Manzana, Gifford 565 (VTM); SAN BERNARDINO COUNTY: Barstow, Hall, December 24, 1918 (UC) Baldwin Lake, Peirson 10488 (UC); RIVERSIDE COUNTY: Banning, J. W. Toumey, September 27, 1894 (UC); WESTERN NEVADA: WASHOE COUNTY: Pyramid Lake, Hall 10883 (UC); Re[illegible] Kenneay, October 19, 1901 (UC); Warm Springs, Hendrix 885 (VTM); [illegible]SBY COUNTY: Carson Sink Region, Kennedy 1699 (UC); northeast of Carson [illegible] Tillotson 269 (VTM, UC); Toll, Stackhouse 10 (VTM); LYON COUNTY: [illegible]ound House, Hall 10880 (UC); Dayton, Stackhouse 60 (VTM, UC); MINERAL COUNTY: Rockland Mine, Hendrix 671 (VTM, UC); Candelaria, Hall 10661 (UC); Soda Springs Canyon, W. H. Shockley 553 (UC); Basalt, Hall 10675 (UC); ESMERALDA COUNTY: Goldfield, Hall, September 9, 1918 (UC).

5d. CHRYSOTHAMNUS NAUSEOSUS var. LEIOSPERMUS (Gray) Hall, Calif. Univ. Pub. Bot. 7:173. 1919 Chart 3, p. 14

Bigelovia leiosperma Gray, Syn. Fl. 12:139. 1884.
Chrysothamnus leiospermus Greene, Erythea 3:113. 1895.
Chrysothamnus nauseosus subsp. leiospermus Hall & Clem. Carnegie Inst. Wash. Pub. 326:217. 1925.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 3, p. 33.) CALIFORNIA: INYO COUNTY: Silver Canyon, White Mts., Wolf 2585 (UC); SAN BERNARDINO COUNTY: Cushenbury Canyon, Munz & Youngberg 14952 (UC); WESTERN NEVADA: WASHOE COUNTY: Warm Springs, Hendrix 883 (VTM, UC); MINERAL COUNTY: Rockland, Hendrix 673 (VTM, UC); ESMERALDA COUNTY: Candelaria, Hall 10669 (UC).

5e. CHRYSOTHAMNUS NAUSEOSUS var. CERUMINOSUS (Dur. & Hilg.) Hall, Calif. Univ. Pub. Bot. 7:175. 1919. Chart 3, p. 15

Bigelovia ceruminosa Gray, Proc. Amer. Acad. Arts & Sci. 8:645. 1873.
Chrysothamnus ceruminosus Greene, Erythea 3:94. 1895.
Chrysothamnus nauseosus subsp. ceruminosus Hall & Clem. Carnegie Inst. Wash. Pub. 326:216. 1925.
Linosyris ceruminosa Dur. & Hilg. Jour. Acad. Nat. Sci. Phila. II. 3:40. 1855.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 3, p. 33.) CALIFORNIA: KERN COUNTY: Tejon Pass, Dr. Heerman, September, 1853 (UC); SAN BERNARDINO COUNTY: Hesperia, Mrs. Spencer, October, 1917 (UC).

5f. CHRYSOTHAMNUS NAUSEOSUS var. MOHAVENSIS (Greene) Hall, Calif. Univ. Pub. Bot. 7:179. 1919. Chart 3, p. 15

Bigelovia mohavensis Greene ex Gray, Syn. Fl. 1^2:138. 1884.
Chrysothamnus mohavensis Greene, Erythea 3:113. 1895.
Chrysothamnus nauseosus subsp. mohavensis Hall & Clem. Carnegie Inst. Wash. Pub. 326:216. 1925.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 3, p. 33.) CALIFORNIA: SANTA CLARA COUNTY: Copernicus Peak, H. K. Sharsmith 1418 (UC); Colorado Creek, Sharsmith 3892 (UC); Mt. Hamilton, Hall 9894 (UC); SAN BENITO COUNTY: Bear Canyon, C. M. Belshaw 2741 (UC); SAN LUIS OBISPO COUNTY: Cuyama Ranch, Peterson 340 (VTM); SANTA BARBARA COUNTY: Big Pine Mountain, French 686 (VTM); Santa Barbara Canyon, Yates 6348 (VTM); VENTURA COUNTY: Mutau Creek, R. S. Baldwin 102 (UC); Thorn Meadows, R. C. Wilson 2 (VTM); Sespe Gorge, Yates 5389 (VTM); Apache Canyon, J. E. Sowder 352 (VTM); Hungry Valley, Peterson 5 (VTM); INYO COUNTY: Oak Creek, Hall 10611 (UC); TULARE COUNTY: Long Canyon, A. Lewis 25 (VTM); KERN COUNTY: Tehachapi Pass, Wolf 2607 (UC); Cambio, Hall 10567 (UC); Greenhorn Range, Hall & Babcock 5090 (UC); Mojave, Hall 10570 (UC); Havilah, Lewis 10 (VTM);

Oak Creek, A. E. Wieslander 356 (VTM); Keller Valley, J. B. Spring 3 (VTM); LOS ANGELES COUNTY: Upper San Antonio Canyon, Johnston 1706 (UC); Swartout Valley, Wolf 2941 (UC); Lancaster, Yates 6353 (VTM); Caswell's, G. T. Nordstrom 400 (VTM); SAN BERNARDINO COUNTY: Fish Creek, Wolf 2479 (UC); Green Lead Mine, Munz 12904 (UC); Baldwin Lake, Munz 12704 (UC); Morongo Valley, Jaeger & Keck, October 3, 1925 (UC); RIVERSIDE COUNTY: Warren's Well, Jaeger, October 21, 1938 (UC).

5g. CHRYSOTHAMNUS NAUSEOSUS var. SPECIOSUS (Nutt.) Hall, Calif. Univ. Pub. Bot. 7:169. 1919. Chart 3, p. 15

Chrysothamnus californicus var. occidentalis Greene, Erythea 3:112. 1895
Chrysothamnus nauseosus subsp. bernardinus Hall & Clem. Carnegie Inst. Wash. Pub. 326:214. 1923.
Chrysothamnus nauseosus subsp. occidentalis Hall & Clem. Carnegie Inst. Wash. Pub. 326:213. 1923.
Chrysothamnus nauseosus subsp. speciosus Hall & Clem. Carnegie Inst. Wash. Pub. 326:211. 1923.
Chrysothamnus nauseosus var. bernardinus Hall, Calif. Univ. Pub. Bot. 7:171. 1919.
Chrysothamnus nauseosus var. macrophyllus J. T. Howell, Leaflets West. Bot. 2:58. 1937.
Chrysothamnus nauseosus var. occidentalis Hall, Calif. Univ. Pub. Bot. 3:60. 1907.
Chrysothamnus occidentalis Greene, Fl. Francisc. 369. 1897.
Chrysothamnus speciosus Nutt. Trans. Amer. Phil. Soc. II, 7:323. 1840.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 3, p. 33.) CALIFORNIA: SANTA CLARA COUNTY: Mt. Umunhum, Roxana Ferris 2086 (UC); LAKE COUNTY: Mt. Konokti, Vernon Bailey, September 24, 1916 (UC); TEHAMA COUNTY: South Yolla Bolla, Merriam & Bailey, October, 1916 (UC); HUMBOLDT COUNTY: Grouse Creek, Chesnutt & Drew, August 2, 1908 (UC); Larrabee Valley, Joseph P. Tracy 8652 (UC); Horse Mountain, Tracy 13005 (UC); SISKIYOU COUNTY: Mt. Eddy, E. B. Copeland 3785 (UC); MacBride Springs, Wm. Bridge Cooke, 11451 (UC); Mt. Shasta, Merriam 183 (UC); Yreka Hills, Hall 10985 (UC); Ager, Merriam, Sept. 24, 1907 (UC); Yreka, Geo. D. Butler 1824 (UC); Hilts, Wieslander 274 (VTM); SHASTA COUNTY: Fall River Mills, Ynez Winblad, Oct. 6, 1934 (UC); Fall River Valley, E. R. Johnson 1190 (UC); Sawpit Gulch, Wieslander & Lewis 342 (VTM); Hoadley Peak, Lundh 181 (VTM); MODOC COUNTY: Alturas, B. C. Goldsmith 1910 (UC); South of Alturas, Hall 11671 (UC); LASSEN COUNTY: Honey Lake Valley, Hall 11680 (UC); PLUMAS COUNTY: Loyalton, Albertus 293 (VTM, UC); Clermont Hill, E. Nourse 7 (VTM, UC); Lee's Camp. M. S. Baker, 296a 26 (UC); Meadow Valley, Nordstrom 246 (VTM); English Bar, Albertus 254 (VTM); Grizzly Peak, Albertus 279 (VTM); Quincy, Nourse 24 (VTM); BUTTE COUNTY: Clear Creek, H. E. Brown 46 (UC); SIERRA COUNTY: Howland Flat, Lewis 518 (VTM); Sulphur Springs, Albertus 288 (VTM); NEVADA COUNTY: Truckee, Hall, August 17, 1917 (UC); Meadow Lake, French 538 (VTM); PLACER COUNTY: Tahoe, C. F. Sonne, September 14, 1884 (UC); Devil's Peak, French 425 (VTM); Truckee River, G. F. Burks 43 (VTM); ELDORADO COUNTY: Cathedral Peak, L. R. Abrams 13411 (UC); Lakeside, Helen D. Geis 109 (UC); Bijou, P. Johannsen 501 (VTM); ALPINE COUNTY: Pacific

Heights, H. Lee 14 (VTM); CALAVERAS COUNTY: Gitena, W. R. Howden 147 (VTM); TUOLUMNE COUNTY: Mather, Hall 11909b (UC); Sawmill Mountain, Belshaw 57 (VTM, UC); Cooper Peak, Bolt 419 (VTM); Upper Relief Valley, Peterson 449; (VTM); Hunter Bend, Belshaw 93 (VTM); Cold Spring, Bolt 467 (VTM); MARIPOSA COUNTY: Fourmile, Peterson 50 (VTM, UC); Yosemite, J. B. Lembert, July, 1895 (UC); El Portal, Peterson 84 (VTM); Alder Ranger Station, E. Sawyer 540 (VTM); MONO COUNTY: Leevining Creek, Hall 10851 (UC); Virginia Creek, Wolf 2530 (UC); Mono Lake, Hall 10854 (UC); Mono Pass, Bolander 6145 (UC); Bridgeport, Bolander 6159 (UC); Long Valley, Wolf 2517 (UC); Farington Ranch, Wolf 2522 (UC); Conway Summit, Hendrix 605 (VTM, UC); Hardy Station, C. A. Graham 212 (VTM, UC); Lundy, Minthorn 185 (UC); Convict Lake, Hall 11898 (UC); Negit Island, Gifford 856 (VTM); Woodfords Highway, F. W. Embree 201 (VTM); Slinkards Valley, W. D. Thomas 196 (VTM); TULARE COUNTY: Little Kern River, Purpus 2040 (UC); Kaweah River Basin, Ralph Hopping 52 (UC); Sugar Bowl, H. E. Bailey, Sept. 7, 1934 (VTM); SANTA BARBARA COUNTY: Pioneer Park, F. H. Raymond 132 (VTM); LOS ANGELES COUNTY: Pine Mountain Ridge, Johnston 1652 (UC); Mescal Creek, Munz 7698 (UC); Reservoir Summit, F. R. Fosberg 7075 (UC); Big Pine Park, Yates 6364 (VTM); SAN BERNARDINO COUNTY: Bluff Lake, Wolf 2485 (UC); Little Green Valley, R. Hall 34 (UC); Little Bear Valley, H. E. Benton 740 (UC); Vivian Creek, Munz 7589 (UC); Mill Creek, Munz 7613 (UC); Forest Home, Wolf 2471 (UC); Baldwin Lake, Peirson 10488 (UC); Riverside Municipal Camp, Wolf 2486 (UC); Tahquitz Peak, C. V. Meyer 613 (UC); Round Valley, Hall 341 (UC); WESTERN NEVADA: WASHOE COUNTY: Broncho Creek, Kennedy 937 (UC); Near Reno, Kennedy 1 (UC); Huffaker, Lee 751 (VTM, UC); Glenbrook, Yates 3877 (VTM); Steamboat Springs, Rose 35552 (UC); Peavine, Lee 686 (VTM); Crystal Bay, Lake Tahoe, Nordstrom 970 (VTM); ORMSBY COUNTY: Fall Creek, C. F. Baker 1495 (UC); Eagle Valley, Baker 1453 (UC); Carson Hills, Hall, Sept. 23, 1918 (UC); LYON COUNTY: Rockland, Hendrix 698 (VTM, UC); DOUGLAS COUNTY: State-line Lake, Hall 10867 (UC); ESMERALDA COUNTY: Lida, Hall 10815 (UC).

5h. CHRYSOTHAMNUS NAUSEOSUS var. CONSIMILIS (Greene) Hall, Calif. Univ. Pub. Bot. 7:176. 1919. Chart 3, p. 15

Chrysothamnus angustus Greene, Pittonia 5:64. 1902.
Chrysothamnus consimilis Greene, Pittonia 5:60. 1902.
Chrysothamnus nauseosus subsp. consimilis Hall & Clem. Carnegie Inst. Wash. Pub. 326:215. 1923.
Chrysothamnus nauseosus subsp. viridulus Hall & Clem. Carnegie Inst. Wash. Pub. 326:215. 1923.
Chrysothamnus nauseosus var. viridulus Hall, Calif. Univ. Pub. Bot. 7:177. 1919.
Chrysothamnus tortuosus Greene, Pittonia 5:63. 1902.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 3, p. 33.) CALIFORNIA: SISKIYOU COUNTY: Gazelle, K. Brandegee, July, 1887 (UC); Shasta Valley, Butler 1839 (UC); Grenada, Heller 12978 (UC); MODOC COUNTY: Lookout, Franklin P. Nutting (UC); Alturas, R. M. Austin, August, 1894 (UC); LASSEN COUNTY: Termo, Wolf 2401 (UC); Wendel, Wolf 2403 (UC); Bieber, Wolf 2397 (UC); SIERRA COUNTY: Campbells Hot Springs, J. A. DeCou 465 (UC); Long Valley, Wilson 649 (VTM); Loyalton, Lewis 542 (VTM); MONO COUNTY: Adobe Valley, Hall 10841 (UC); Dogtown, Hall 10865 (UC); Mono Lake, Hall 10846 (UC); Hardy Station, G. A. Graham 210 (VTM, UC); Bridgeport, Graham 224 (VTM, UC); County Farm, Gifford 844 (VTM); Warm Springs Flat, Hendrix 541 (UC); Fales Hot Springs, Graham 206 (VTM); Benton, Hall 10830 (UC); Mono Mills, Wolf 2553 (UC); Farington Ranch, Wolf 2524 (UC); Pellisier Ranch, J. Grinnell, September 22, 1917 (UC); INYO COUNTY: Jackass Spring, Panamint Mts., Grinnell, October 2, 1917 (UC); Independence, Hall 10605 (UC); Kearsarge, Hall 10603 (UC); Bishop, Hall 10619 (UC); Zurich, Hall 10618 (UC); Lone Pine, Hall 10825 (UC); Cartago, Hall 10593 UC); Laws, Hall 10680 (UC); KERN COUNTY: Rosamond, Wolf 2619 (UC); LOS ANGELES COUNTY: Swartout Valley, Munz 7701 (UC); Lancaster, Hall 10575 (UC); Upper San Antonio Canyon, Johnston 1706 (UC); Pine Mt. Ridge, Johnston 1653 (UC); Dry Lake, Hall 10580 (UC); WESTERN NEVADA: WASHOE COUNTY: Warm Springs, Hendrix 880 (VTM, UC); Pyramid Lake, Hall 10550 (UC); Reno, K. Brandegee, August, 1883 (UC); Junction House, A. Simontacchi 381 (VTM); Peavine Peak, Lee 706 (VTM); Wedge of Sink, Bolt 815 (VTM) ORMSBY COUNTY: Carson City, Hall 10869 (UC); Carson Valley, Hall 10872 (UC); LYON COUNTY: Rockland, Hendrix 696 (VTM, UC); Dayton, Hall 10879 (UC); Alkali Flat, Johannsen 1280 (VTM); DOUGLAS COUNTY: Mineral Peak, Stackhouse 31 (VTM, UC); MINERAL COUNTY: Sodaville, Hall 10672 (UC); ESMERALDA COUNTY: Mt. Montgomery Station, Hall 10659 (UC); Fish Lake Valley, Jaeger, September 8, 1938 (UC); Lida, Hall 10814 (UC); Goldfield, Hall 10808 (UC).

6a. CHRYSOTHAMNUS VISCIDIFLORUS (Hook.) Nutt. (typical form), Trans. Amer. Phil. Soc. II, 7:324. 1840. Chart 1, p. 5 and Chart 4, p. 19

Bigelovia Douglasii Gray, Proc. Amer. Acad. Arts & Sci. 8:645. 1873
Bigelovia Douglasii var. latifolia Gray, Proc. Amer. Acad. Arts & Sci. 8:646. 1873.
Bigelovia Douglasii var. serrulata Gray, Proc. Amer. Acad. Arts & Sci. 8:646. 1873.
Bigelovia Douglasii var. tortifolia Gray, Proc. Amer. Acad. Arts & Sci. 8:646. 1873.
Chrysothamnus Douglasii Clements & Clements, Rocky Mt. Fls. 266. 1914.
Chrysothamnus latifolius Rydb. Bul. Torrey Bot. Club 33:152. 1906.
Chrysothamnus serrulatus Rydb. Bul. Torrey Bot. Club 33:152. 1906.
Chrysothamnus stenolepis Rydb. Bul. Torrey Bot. Club 37:131. 1910.
Chrysothamnus tortifolius Greene, Fl. Francisc. 368. 1897
Chrysothamnus viscidiflorus subsp. latifolius Hall & Clem. Carnegie Inst. Wash. Pub. 326:184. 1923.

Chrysothamnus viscidiflorus subsp. typicus Hall & Clem. Carnegie Inst. Wash. Pub. 326:183. 1923.
Chrysothamnus viscidiflorus var. latifolius Greene, Erythea 3:96. 1895.
Chrysothamnus viscidiflorus var. serrulatus Greene, Erythea 3:96. 1895.
Chrysothamnus viscidiflorus var. tortifolius Greene, Erythea 3:96. 1895.
Linosyris serrulata Torrey ex Stansbury, Rep., ed. 1:389. 1851.
Linosyris viscidiflora var. latifolia Eaton, Bot. King's Expl. 157. 1871.
Linosyris viscidiflora var. serrulata Torrey ex Stansbury, Rep., ed. 2:389. 1853.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 4, p. 34.) CALIFORNIA: SISKIYOU COUNTY: Cedar Park School, H A Jensen 344 (VTM); Goosenest foothills, Butler 1731 (UC); MODOC COUNTY: Fort Bidwell, M. H. Manning 27 (UC); LASSEN COUNTY: Bieber, Wolf 2396 (UC); PLUMAS COUNTY: Sattley, Sawyer 69 (VTM); Grizzly Peak, Albertus 276 (VTM); Beckwith, Keck 4902 (UC); SIERRA COUNTY: Purdy, Nordstrom 953A (VTM, UC); Loyalton, Lewis 549 (VTM); Sierraville, Albertus 285 (VTM, UC); Sierra Valley, J. G. Lemmon, June, 1874 (UC); NEVADA COUNTY: Floriston, French 554 (VTM); Truckee, Heller 7189 (UC); PLACER COUNTY: Tahoe, Sonne, September 14, 1886 (UC); ALPINE COUNTY: Whitecliff Peak, Albertus 343 (VTM); MONO COUNTY: Slinkards Valley, Thomas 192 (VTM); Bush Mountain, Peterson 591 (VTM); Conway Summit, Hendrix 538 (VTM, UC); Crags Hotel, Hendrix 308 (VTM); Monte Cristo, G. A. Graham 88 (VTM); Benton, Hall 10650 (UC); Mono Lake, Hall 10857 (UC); Farington Ranch, Wolf 2523 (UC , Leevining Creek Canyon, Wolf 2544 (UC); Mono Mills, Wolf 2554 (UC); INYO COUNTY: Jackass Spring, Grinnell, October 2, 1917 (UC); TULARE COUNTY: Long Canyon Lewis 31 (VTM); VENTURA COUNTY: Mt Pinos, Grinnell 31 (UC); SAN BERNARDINO COUNTY: Cienega Seca Creek, Munz 6304 (UC); RIVERSIDE COUNTY: San Jacinto Mt., J. C. Nevin (UC); WESTERN NEVADA: WASHOE COUNTY: Wadsworth E. Palmer 257 (UC), Peavine Peak, Lee 699 (VTM ; Steamboat Spring, Bradshaw 197 (VTM, UC); Huffaker, Lee 752 (VTM, UC); Tule Peak, C. A. Graham 158 (VTM); Reno, Graham 10 (VTM); Five Mile House, Adams 123 (VTM); Washoe, Bradshaw 198 (VTM); Pyramid Simontacchi 539 (VTM); Sugar Loaf, Hendrix 819 (VTM); Cold Spring Wilson 646 (VTM); STOREY COUNTY: Virginia City, Adams 51 (VTM); ORMSBY COUNTY: Snow Valley, C. F. Baker 1440 (UC); King s Canyon, Baker 1501 (UC); Toll, Stackhouse 12 (VTM, UC); LYON COUNTY. Rockland, Hendrix 705 (VTM, UC)

6b. CHRYSOTHAMNUS VISCIDIFLORUS var. PUBERULUS (D. C Eaton) Jepson, Man. Fl. Pl. Calif. 1031. 1925. Chart 4, p. 19

Bigelovia Douglasii var. puberula Gray, Proc. Amer. Acad. Arts & Sci. 8:646. 1873.
Chrysothamnus humilis Greene, Pittonia 3:24. 1896.
Chrysothamnus puberulus Greene, Erythea 3:93. 1895.
Chrysothamnus viscidiflorus subsp. humilis Hall & Clem. Carnegie Inst. Wash. Pub. 326:182. 1923.
Chrysothamnus viscidiflorus subsp puberulus Hall & Clem. Carnegie Inst. Wash. Pub. 326:182. 1923.
Chrysothamnus viscidiflorus var. humilis Jepson, Man. Fl. Pl. Calif. 1031. 1925.
Linosyris viscidiflora var. puberula Eaton, Bot. King's Expl. 158. 1871.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 4, p. 34.) CALIFORNIA NEVADA COUNTY: Martis Valley, Sonne, August, 1895 (UC); MONO COUNTY: County Farm, Gifford 842 (VTM, UC); Virginia Canyon, Yates 6278 (VTM); Pittsburg Liberty Mine, G. A. Graham 229 (VTM); Virginia Creek, Wolf 2531 (UC); Sherwin Hill, Wolf 2514 (UC); Mono Lake, Peirson, August 1, 1933 (UC); Benton, Hall 10677 (UC); Lower Twin Lake, Hendrix 314 (VTM); INYO COUNTY: Cedar Flat, Victor Duran 2839 (UC); WESTERN NEVADA: Peavine Peak, Lee 709 (VTM); Reno, C. A. Graham 59 (VTM); Cold Springs, Lee 717 (VTM, UC); Junction House, Bolt 817 (VTM); Warm Springs, Hendrix 879 (VTM); Huffaker, Lee 746 (VTM); Sink, Bolt 816 (VTM); Poeville, Bolt 821 (VTM); Steamboat, Adams 68 (VTM); Spanish Spring, Saarni 88 (VTM); STOREY COUNTY: Five Mile House, Adams 29 (VTM); DOUGLAS COUNTY: Youngs Crossing, Thomas 119 (VTM); Colony, Hendrix 1099 (VTM); MINERAL COUNTY: Sweetwater, G. A. Graham 64 (VTM, UC); ESMERALDA COUNTY: Goldfield, Heller 10973 (UC); Candelaria, Hall 10668 (UC).

6c. CHRYSOTHAMNUS VISCIDIFLORUS var. PUMILUS (Nutt.) Jepson, Man. Fl. Pl. Calif. 1031. 1925. Chart 4,p. 19

Bigelovia Douglasii var. pumila Gray, Syn. Fl. 12:140. 1884.
Bigelovia Douglasii var. stenophylla Gray, Proc. Amer. Acad. Arts & Sci. 8:646. 1873.
Chrysothamnus pumilus Nuttall, Trans. Amer. Phil. Soc. II, 7:323. 1840.
Chrysothamnus pumilus β euthamoides Nutt. Trans. Amer. Phil. Soc. II, 7:323. 1840.
Chrysothamnus stenophyllus Greene, Erythea 3:94. 1895.
Chrysothamnus viscidiflorus subsp. pumilus Hall & Clem. Carnegie Inst. Wash. Pub. 326:182. 1923.
Chrysothamnus viscidiflorus subsp. stenophyllus Hall & Clem. Carnegie Inst. Wash. Pub. 326:183. 1923.
Chrysothamnus viscidiflorus var. stenophyllus Hall, Calif. Univ. Pub. Bot. 3:59. 1907.
Linosyris pumila Gray, Pl. Wright. 2:80. 1853.

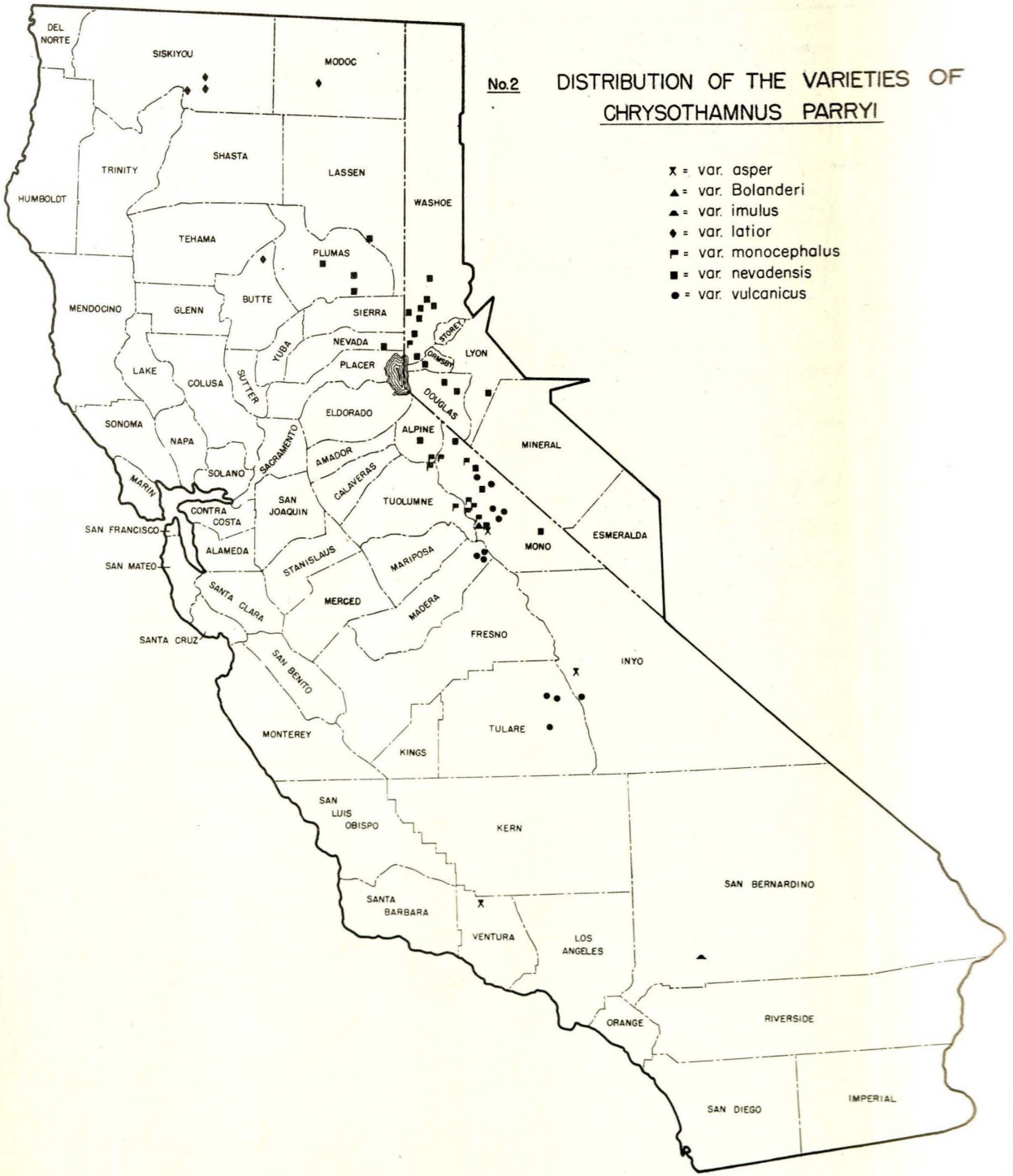
SPECIMENS TO VERIFY RANGE: (See Distribution Map 4, p. 34.) CALIFORNIA: MONO COUNTY: Warm Springs Flat, Hendrix 540 (VTM, UC); INYO COUNTY: Cottonwood Creek Canyon, Purpus 1908 (UC); TULARE COUNTY: Whitney Meadows, Purpus 1894 (UC); SAN BERNARDINO COUNTY: Bear Lake, Grinnell 73 (UC); Bear Valley, Abrams 2889 (UC); Holcomb Valley, Munz 12901 (UC); Baldwin Lake, Munz 12716 (UC); WESTERN NEVADA: WASHOE COUNTY: Tule Peak, Bolt 733 (VTM); Huffaker, Lee 747 (VTM); LYON COUNTY: Rockland, Hendrix 686 (VTM, UC); ESMERALDA COUNTY: Candelaria, Shockley 310 (UC); Basalt, Hall 10674 (UC); Goldfield, Hall 10534 (UC).

7. CHRYSOTHAMNUS DEPRESSUS Nutt., Jour. Phila. Acad., II, 1:171. 1847 Chart 1, p. 5

Bigelovia depressa Gray, Proc. Amer. Acad. Arts & Sci. 8:643. 1873.
Linosyris depressa Torrey ex Sitgreaves, Rep. 161. 1854.

SPECIMENS TO VERIFY RANGE: (See Distribution Map 1, p. 31.) CALIFORNIA: SAN BERNARDINO COUNTY: Keystone Spring, New York Mountains, Munz 13875 (UC); Clark Mountains, Jones, September 13, 1932 (UC); Clark Mountain, Munz 12887 (UC).

No I DISTRIBUTION OF FOUR CHRYSOTHAMNUS SPECIES
x = C. albidus
■ = C. depressus
▲ = C. paniculatus
● = C. teretifolius
DEL NORTE
SISKIYOU
MODOC
TRINITY
SHASTA
LASSEN
HUMBOLDT
WASHOE
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
STOREY
NEVADA
YUBA
LYON
LAKE
COLUSA
SUTTER
PLACER
ORMSBY
DOUGLAS
SONOMA
NAPA
ELDORADO
ALPINE
MINERAL
SACRAMENTO
AMADOR
SOLANO
MARIN
CALAVERAS
SAN JOAQUIN
TUOLUMNE
CONTRA COSTA
MONO
SAN FRANCISCO
ESMERALDA
ALAMEDA
STANISLAUS
MARIPOSA
SAN MATEO
SANTA CLARA
MERCED
MADERA
FRESNO
SANTA CRUZ
INYO
SAN BENITO
MONTEREY
TULARE
KINGS
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL


No.2 DISTRIBUTION OF THE VARIETIES OF CHRYSOTHAMNUS PARRYI
x = var. asper
▲ = var. Bolanderi
▲ = var. imulus
♦ = var. latior
▀ = var. monocephalus
■ = var. nevadensis
● = var. vulcanicus
DEL NORTE
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
WASHOE
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
STOREY
NEVADA
LYON
LAKE
COLUSA
SUTTER
YUBA
PLACER
ORMSBY
DOUGLAS
SONOMA
NAPA
SOLANO
SACRAMENTO
ELDORADO
ALPINE
AMADOR
MINERAL
MARIN
CONTRA COSTA
SAN JOAQUIN
CALAVERAS
TUOLUMNE
SAN FRANCISCO
ALAMEDA
STANISLAUS
MARIPOSA
MONO
ESMERALDA
SAN MATEO
SANTA CLARA
MERCED
MADERA
SANTA CRUZ
FRESNO
INYO
SAN BENITO
MONTEREY
TULARE
KINGS
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL

No.3 DISTRIBUTION OF THE VARIETIES OF CHRYSOTHAMNUS NAUSEOSUS
= var. albicaulis
= var. ceruminosus
= var. consimilis
= var. gnaphalodes
= var. hololeucus
= var. leiospermus
= var. mohavensis
= var. speciosus
DEL NORTE
SISKIYOU
MODOC
SHASTA
LASSEN
WASHOE
TRINITY
HUMBOLDT
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
LAKE
YUBA
NEVADA
PLACER
LYON
COLUSA
SUTTER
ELDORADO
DOUGLAS
SONOMA
NAPA
SACRAMENTO
AMADOR
ALPINE
MINERAL
MARIN
SOLANO
CALAVERAS
SAN JOAQUIN
CONTRA COSTA
TUOLUMNE
MONO
ESMERALDA
SAN FRANCISCO
ALAMEDA
STANISLAUS
MARIPOSA
SAN MATEO
SANTA CLARA
MERCED
MADERA
SANTA CRUZ
FRESNO
INYO
SAN BENITO
MONTEREY
TULARE
KINGS
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL

No.4 DISTRIBUTION OF THE VARIETIES OF CHRYSOTHAMNUS VISCIDIFLORUS
= var puberulus
= var. pumilus
= var (typical form)
DEL NORTE
SISKIYOU
MODOC
TRINITY
SHASTA
LASSEN
HUMBOLDT
WASHOE
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
STOREY
COMSTOCK
NEVADA
YUBA
LYON
LAKE
COLUSA
SUTTER
PLACER
DOUGLAS
ELDORADO
SONOMA
NAPA
SACRAMENTO
ALPINE
MINERAL
AMADOR
SOLANO
MARIN
CALAVERAS
SAN JOAQUIN
TUOLUMNE
CONTRA COSTA
SAN FRANCISCO
ALAMEDA
MONO
ESMERALDA
STANISLAUS
MARIPOSA
SAN MATEO
SANTA CLARA
MERCED
MADERA
FRESNO
SANTA CRUZ
INYO
SAN BENITO
TULARE
MONTEREY
KINGS
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL

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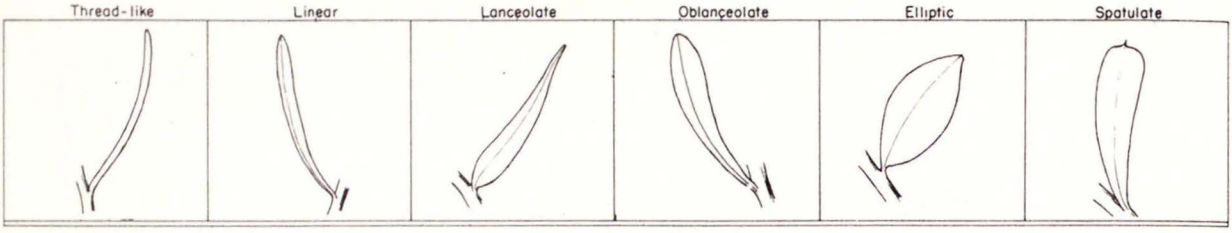
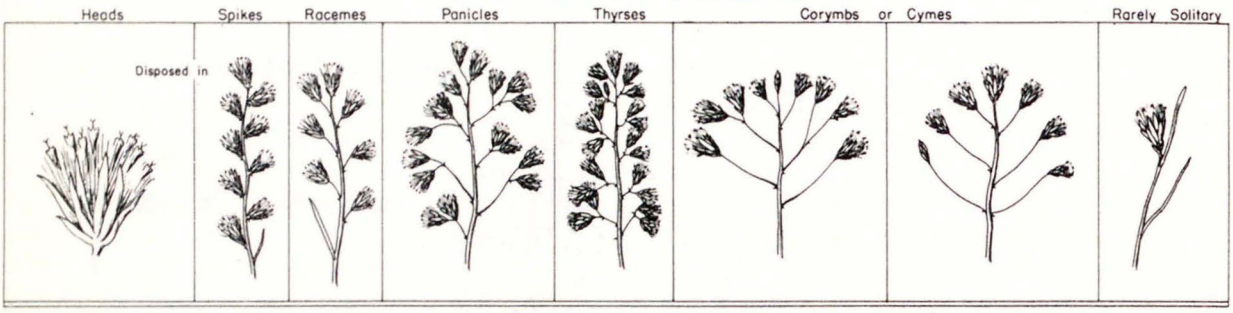
ILLUSTRATED GLOSSARY

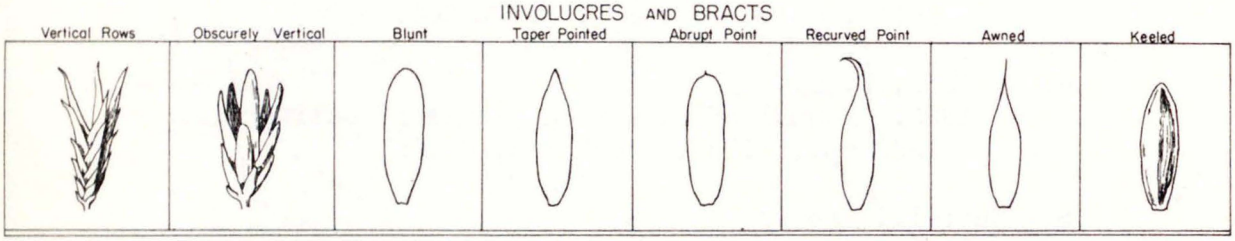
LEAVES



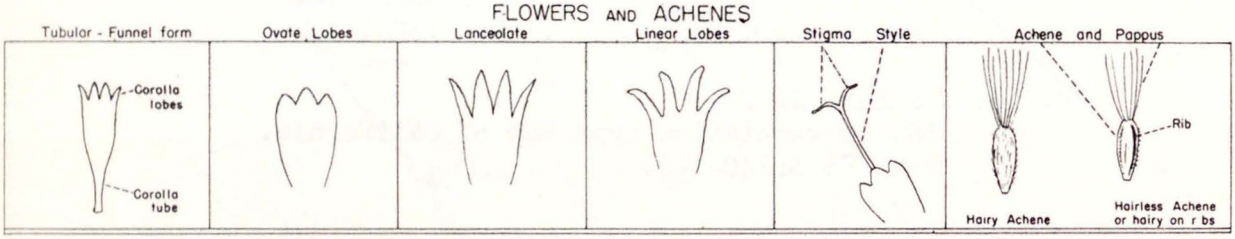
FLOWER CLUSTERS (INFLORESCENCE)



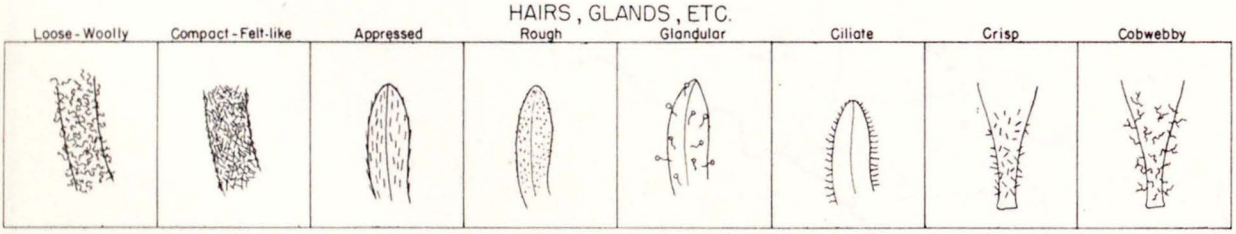
INVOLUCRES AND BRACTS

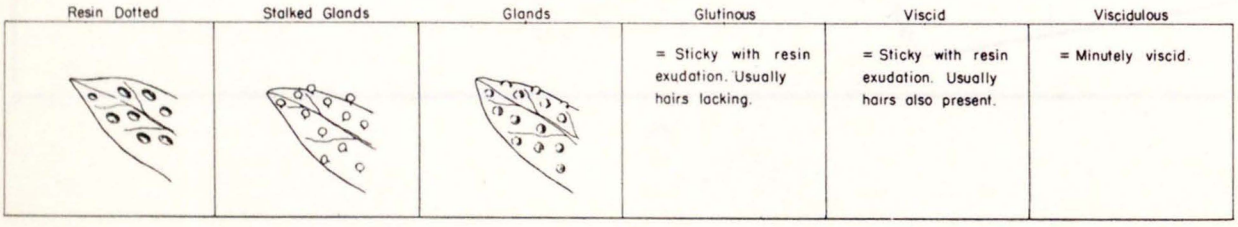


FLOWERS AND ACHENES



HAIRS, GLANDS, ETC.





Glutinous = Sticky with resin exudation. Usually hairs lacking.

Viscid = Sticky with resin exudation. Usually hairs also present.

Viscidulous = Minutely viscid.

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